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Vol. IV *May, 1901* *No. 5*

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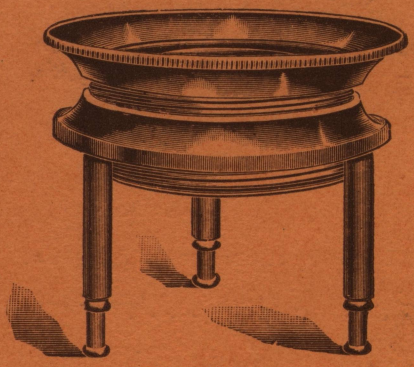
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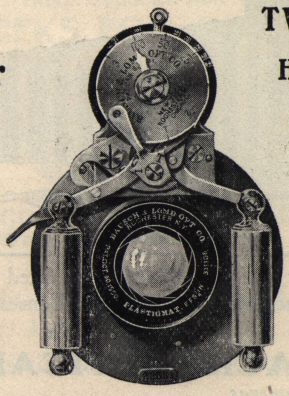
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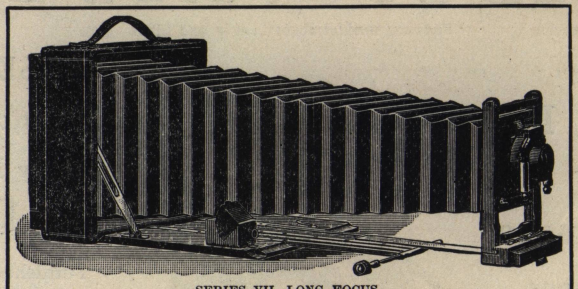
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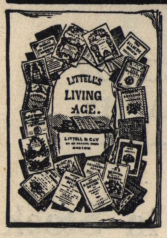
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VOLUME IV. MAY, 1901. NUMBER 5

The University of Montana Biological Station.

Most of our Eastern friends who have not been through this Western country and have not seen its vastness in extent, its difficulties owing to the absence of roads and means for transportation, can scarcely comprehend the work necessary to carry on any amount of collecting or study in the field. The idea to be conveyed through this paper is to state what has been attempted in this line, the success that has been achieved, and the suggestions to be offered from the experiences of the past two years.



FIG. 1. CAMP AT SIN-YALE-A-MIN LAKE.

In the spring of 1899 plans were completed for the establishment of out-door work on a moderate scale, the location to be selected. A week was spent in the region of Flathead lake, Mont., and all available sites examined. A location was secured on the northern end of the lake, on the bank of Swan river, close to the outlet. The location was chosen as possessing the following advantages: The mouth of Swan river offers a harbor for boats, very few harbors being found on the lake. Swan river affords excellent fishing, and the region round about is a dense forest, practically untouched. This is one of the most convenient places to

reach from the Great Northern railroad on the north, and the Northern Pacific on the south, is on the regular wagon road, is easily reached by steamboat, and is but a short distance from the mouth of the Flathead river, which has abundance of marshes and swamps. This is one of the few places on the lake where suitable accommodations are to be had for board and lodging.

During the past season a month was spent in the Mission mountains, which extend north and south along the lake and Mission valley for a distance of nearly a hundred miles. The southern end of the range has a number of high peaks, the highest above ten thousand. The range slopes down toward the northern end. This northern end has been ground off by a glacier, which has left undisputable proof of its work on the tops of the high hills. The range ends at the Swan river, about where the laboratory is situated.

One of the highest peaks at the southern end is Sin-yale-a-min mountain, the Indian word meaning "surrounded." A ten days camp was made at the small



FIG. 2. CANVAS BOAT "DAPHNIA" WITH COLLECTING OUTFIT.

lake at the base of this mountain, and called also Sin-yale-a-min lake. The lake lies in the heart of the mountains, with high peaks on all sides except the west, which is dammed up by an old moraine, though it is of recent geological origin.

A general view of the camp at Sin-yale-a-min lake is given in Fig. 1. The party at this place, all told, numbered twenty-one, and with one or two exceptions all were engaged in some work. This lake is about fifteen miles from the nearest point on the Northern Pacific railroad, and is in the Flathead Indian reservation. It is therefore primitively wild and romantic.

The work on the lake was accomplished through the use of a fourteen-foot canvas boat, which was taken with some misgivings, but which proved all that was predicted for it by the makers. The boat, ready for use, is shown in Fig. 2, the photograph being taken later at Swan lake when fixed ready for use. The canvas boat carried heavy loads, having at one time four grown people and one child, guns, ammunition, nets, and other material. In the illustration it is shown

loaded as it was when used for actual work, with two occupants in addition to the material. At the front is seen the pump after plans by Ward, for taking entomostraca and other fresh water species. Hanging over the side of the boat is the net after plans by Kofoid, for straining the pumpings. To the right of the net is to be seen the apparatus for measuring depth, which is an instrument used in electric light plants and other establishments for measuring wire. The rubber hose for attachment to the pump is also seen. Of this hose one hundred and forty feet were carried.



FIG. 3. FIELD TABLE AT SIN-YALE-A-MIN LAKE, FOR MICROSCOPICAL WORK.

The canvas boat was used continuously, and is about the only available means for work in these mountain lakes, so remote from civilization, where transportation is a grave problem. It was necessary to use common garden hose, owing to the fact that no other kind was kept in stock, and owing to the further fact that large hose and a large pump would be too difficult to handle.

In Fig. 3 is shown the laboratory table of the microscopist in his study of the entomostraca and other forms. This consists of two sticks nailed to a fir tree at the desired height, and a couple of rough boards nailed to the top of these sticks. The location is selected in the shade, so that it is always comfortable. The lake is at an altitude or 3800 feet, and the cold water makes the surrounding air cool, so that when one is in the shade one is always comfortable. Unfortunately the microscopist was not aware the picture was being taken, and while the lower part of the body shows, the upper part is lacking. As this happens to be the only negative worth saving, the picture is shown to illustrate the ingenuity in making a table. The eye of the naturalist will readily take in the situation, working at the fresh material from a lake never before visited, with the beautiful sheet of water but a few feet away.

In this work a small microscope was carried, with a battery of objectives, and a few necessary stains, dishes, slips, covers, and the like. The material could be taken from the water and studied immediately. It may be well to say at this time of the year, July, rain seldom falls, so there is little difficulty from that source. When there was danger, or when the sun was too hot, a tarpaulin was made into a roof with ropes, which answered as protection. In case of emergency it required but a few minutes to put all the material under cover of the tents.

A similar camp was made at McDonald lake, about fifteen miles further north, in the same range, and in the same reservation. The camp at this lake was for the purpose of collecting additional material in shells, of which a new species had

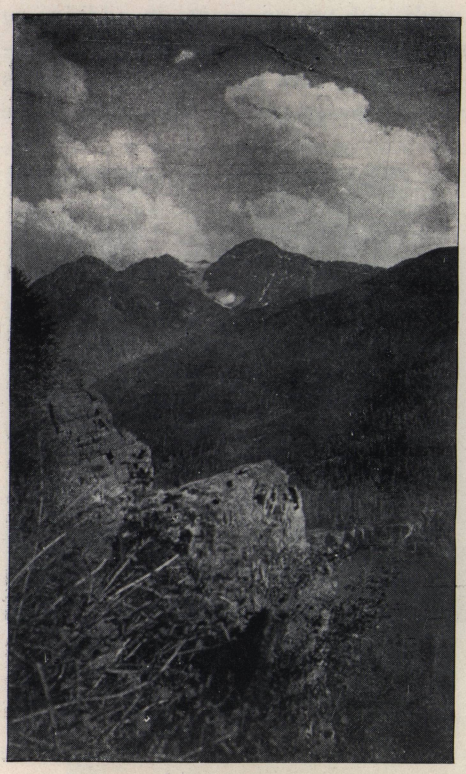


FIG. 4. McDONALD PEAK AND LAKE.

been found the year previously, and to determine the microscopical life of the waters in comparison with those of Sin-yale-a-min lake. The view shown in Fig. 4 will give to the mountain lovers an idea of the beautiful peak that was always before us. This peak, McDonald, rises to a height of over ten thousand feet. The view here given was taken from the mountain side near camp. Photographers may be interested in knowing that the picture was taken on a Seed orthochromatic plate, the exposure being a fiftieth of a second. The plate was somewhat under exposed, but for the purpose desired, which was to bring out the peaks with the clouds above, the effect was successful.

McDonald lake is much similar to Sin-yale-a-min lake. The length is about a mile and a quarter, the width less than a quarter, the depth 68 feet. Sin-yale-a-min lake was some longer, considerably wider, and in the deepest 250 feet. McDonald lake is surrounded on all sides by high and rugged mountains, save at the west, where a moraine has made a dam as in the case of the lake before mentioned.

Work at this lake was conducted much as in the first case. The microsco-



FIG. 5. ORNITHOLOGISTS AT WORK AT McDONALD LAKE.

pist rigged up a table similar to the one described, having saved the lumber and nails, both being a necessary feature in the unsettled region. The ornithologists are shown at work in Fig. 5. This table and roof is similar to that made use of in all camps. The lake lies in the middle foreground, just out of sight, being lower down. Under the table are to be seen various sizes of zincs, cylindrical in form, and almost closed. These are used for placing and holding the made skins while they dry. It is often necessary to pack the skins before they are dry, and even afterward the jolting the mountain roads give them is something very difficult to understand except by those who have been over the ground. By placing each skin in a zinc cylinder, the cylinders being of different sizes and lengths to accommodate different sized birds, it is then an easy matter to pack the skins, and at any time get them out to dry without danger of injuring the feathers and spoiling the shape. It is true the zincs are heavy, but they seem to be a necessity in this kind of work. They work as well with mammal skins, and are also employed in preserving small mammal skins.



FIG. 6. VIEW OF UPPER END OF FLATHEAD LAKE, SWAN RIVER OUTLET.

For the ornithologists long excursions were unnecessary, as the region all about is dense woods up to the mountain sides, and it was necessary but to take a handful of shells and go a few steps from camp in order to secure enough specimens for a half day's work. The picture was taken on a Seed orthochromatic plate with ray filter.

It is needless to relate instances of camp life, or to describe further methods of work. It is in order to say, however, that to change camp and get to the station, a distance of only about fifty miles, one must descend a thousand feet over bad road with all the paraphernalia of camp, and, with all material, cross the reservation, a distance to the lake of twenty or twenty-five miles, taking a day, dump the material off at the lake shore and again pile it on the small launch or the large steamer, whichever is taken, cross the lake, a distance of about thirty miles, again unload, and establish camp or take quarters at the farm house near. But the

ride is one never to be forgotten, especially if the sun is shining and the atmosphere is clear so as to bring out the beauties of the mountains and the waters of the lake bathing the base of the range.

Figure 6 gives a better idea of the country adjacent to the University of Montana Biological Station than could be given in any description. The view is toward Flathead lake, which is in the middle of the illustration. The water in the foreground to the left is Swan river, whose outlet into the lake is just beyond the bend. The location of the station is on the bank of the river a few feet to the left of the river at the left in the illustration. The narrow point of land behind the trees by the house is the bar made by the sediment from Flathead river, which enters the lake at this point, and which is some two and a half miles distant. The mountains in the background are the Cabinet range.

The field laboratory and camping ground are shown in Fig. 7, seen from the



FIG. 7. EXTERIOR UNIVERSITY OF MONTANA BIOLOGICAL LABORATORY AND CAMPING GROUND.

rear, the only place from which a picture can be taken. Immediately in front of the building is the Swan river, which has a bank here of some forty or fifty feet. Directly in front of the building, and at the water's edge, is a large spring, which furnishes an abundance of pure water, though the river water is clear and pure. There is abundance of room for tents. It has been the custom to live in tents and take meals at the hotel shown in Fig. 7, though since the picture was taken a large house has been erected, offering excellent accommodations to those attending.

The field laboratory is not large. It was planned as a convenient outdoor laboratory for work. It will be understood that when erected the building was about twenty miles from Kalispell, the nearest town. Carpenters, lumber, and material were difficult to secure, and the attendance upon the work was very problematical. The plan was to make a building suited to the needs of a few men who might devote a month or more annually to investigation in the immediate region, and at the same time offer the privileges to any who might wish to take advantage of the offer.

The state of Montana has 146,000 square miles of territory. There is a population in round numbers of 250,000 people. Of this number there is not a large number who wish to engage in such study, and the expense of getting around is no small item. The station was therefore primarily to offer a haven for a few enthusiasts who have planned to do something toward the working up of the material of the state, with the hope that the enthusiasm and interest would be more or less contagious, and that in time there would be work of considerable importance and by considerable numbers at the laboratory.

The two seasons the laboratory has been opened the work has progressed well, and was all that could be expected. During the summer of 1900 the laboratory was taxed to its utmost. Figure 8 shows a portion of the interior, with the students at work. The tables are rude, and the chairs have been constructed from raw lumber by unskilled hands, but the material with which they



FIG. 8. INTERIOR OF LABORATORY.

work is from the university laboratory, and is the best the country affords. Above the door may be seen rows of bird skins. To the left is the working library of a couple of hundred volumes. In the rear, not shown, is the photographic dark room and store room. With this small building, accommodating no more than a dozen or fifteen at a time, there has been made a start which it is hoped will later develop into something of importance.

Figure 9 is an illustration that will interest, if not please, many readers of the JOURNAL. Red-Horn, an Indian who had been on a visit to the Blackfeet in the northern part of the state, and was returning to his home on the Flathead reserve, made us a visit. He was much interested in our work, and seemed to want to know what was being done. He was shown various things through the microscope, which pleased him greatly. I persuaded him to let me take his picture, and the pleasure he is having is shown by the smile on his countenance. He was then taken into the dark room, where he watched the picture develop. Later

he received a print, and some months afterward I showed him his picture in the daily paper, which he at once recognized and readily understood.

The number of visitors at the station while work has been under progress has



FIG. 9. A NEW STUDENT ARRIVES AT THE LABORATORY.

been considerable, including the governor of the state, many school men of prominence, a number of government men, and many citizens and others from the region.

The equipment of the station as regards boats is shown in Fig. 10. A gasoline launch and a row-boat, besides the canvas boat, offer abundant facilities so far for all who have attended, and for those having charge of the work. In addition to these, the launch shown in the illustration to the rear may be chartered at any time, and will carry several tons, being 32 feet beam. The pump, net, hose, sounding apparatus, and life preservers have been put out to dry. These boats are in the harbor shown in Fig. 7, being just below the windmill in that picture.

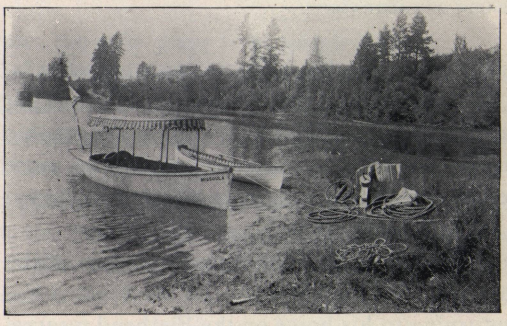


FIG. 10. STATION BOATS AND EQUIPMENT.

By means of these boats considerable work has been done on the lake. Soundings have been taken in many places, and pumpings made from various depths. The row-boat is also taken in wagon to the smaller ponds adjacent to the station, and thus renders the work there effective.

The location of the station is ideal in many respects. No one may hope for much interest to be taken in such work by the younger element, to whom we must look for future work, without making ample provision for recreation, so as

to combine work with recreation. This is especially true of teachers who wish a change, and are seeking a place where they may have a chance to work, and when work is over have a little enjoyment. During the first summer the number of plates exposed within a couple of miles of the station amounted to several hundred. There were more than a half dozen cameras, and they were in almost constant use. The dark room was in use most of the time both day and night. During the second season the number of exposures was still greater. The rapids above the station are a delight to the eye, a pleasant place to roam when there is nothing to do, and a great resort for the fishermen. The lake beach is beautiful, and many romantic bits of it have been taken. The number of illustrations accompanying this paper is already too large, or more would be shown. It is sufficient to say that the writer brought home from the summer's trip, including the work at the station, more than a hundred and twenty-five good negatives, each illustrating something in geology, physical geography, or biology.



FIG. 11. A FLASH LIGHT AROUND THE CAMP FIRE.

Bathing in the lake is excellent. The bottom is smooth and sandy, and any depth desired may be obtained. The water is usually comfortable, the cold water from the rivers not reaching this portion of the lake.

Figure 11 is given as an illustration of an attempt to take a flashlight of a group around the camp fire at night. The magnesium was placed in a tin pan with a paper between the powder and the pan, the paper trailing outside so as to give a chance for lighting. The pan was placed on a bench with a tent as background. Nearly an ounce of magnesium was found necessary to produce a satisfactory picture. The camera was placed, and the person in the middle of the group was given a candle, which was used to determine when a sharp focus was obtained. By giving the candle to the party at one end, then transferring it to the other end, a suitable arrangement was had. The shutter was opened about the time the trail of paper was lighted, after which the operator walked around and took a place in the group. After the flash he returned to the camera, closed the shutter, and later made development. On this occasion there was enough smoke to make part of the picture a trifle hazy.



FIG. 12. AN EXPERIMENT IN REARING DRAGON FLIES.

Figure 12 is a device suggested by Calvert for rearing dragon-flies, suitable environment having been obtained. The cylinders of wire netting are placed in the water, and the insects placed therein. When they transform it is possible to identify the adults, and consequently distinguish between young. The picture given is from an experiment performed at the laboratory.



FIG. 13. INTERIOR OF NEST OF WRIGHT'S FLYCATCHER.

Figure 13 illustrates to photographers the possibilities of taking bird nests in-doors. The nest is that of Wright's flycatcher, *Empidonax wrightii, Baird.* A position was taken in front of the window, though out of the direct sun. A black felt cloth was used as a background, the nest being set on the cloth in the angle made by the table and a pile of books. A mirror was adjusted so as to throw light into the nest, as the side next the window was naturally darker than the other. The nest was several inches long, but was inclined so as to be parallel to the lens, hence the observer is looking into the nest. The plate is a Seed orthochromatic, with ray filter, small stop. The fluffy appearance of the surface is due to the cottony material with which the nest is lined. By this same arrangement a series of pictures of nests was taken, without moving the apparatus.

The biological station will be open for the summer of 1901 from July 22 to August 17. The six weeks preceding will be spent in the adjacent region collecting. Five days of the week during the time the station is open will be spent in work, the sixth will be taken for excursions. As is usual, there are no fees in connection with this work, all of the material being provided free, and the teaching force giving their time gratuitously. Those attending will be asked to pay for what is broken or consumed, and to pay their living expenses.

Accommodations are better than heretofore. The post-office, Big Fork, has during the past year been established at the store close by the station. The Kalispell electric light plant is across the river, and several houses have sprung up during the summer. Daily mail, electric light, a railroad just built a short distance away, a new hotel, and other conveniences, make living less wild and more natural, and will give greater opportunity to those who wish to attend.

As the result of the two years' work thus far accomplished, several bulletins are ready for publication, and several others are under way. There is a fine opportunity for work, and plenty of material, in a new country, with practically no opposition; but the workers are too few and life too short.

MORTON J. ELROD.

University of Montana, Missoula, Mont.

The Marine Biological Laboratory at Cold Spring Harbor, L. I.

The twelfth annual session of this laboratory will be held during the months of July and August, of the present year, under the directorship of Professor C. B. Davenport. The regular class-work will begin Wednesday, July 3, and will continue for six weeks; the laboratory will be open from July 1 until August 24, but investigators may make arrangements for using it from the middle of June until the middle of September.

Cold Spring Harbor is about thirty miles from Brooklyn, on the north shore of Long Island. It is a deep, funnel-shaped inlet of Long Island Sound, with steep, wooded shores, about five miles long, and one and a quarter miles wide at its broad end, where it joins the sound. It is divided by a long sand-spit near its

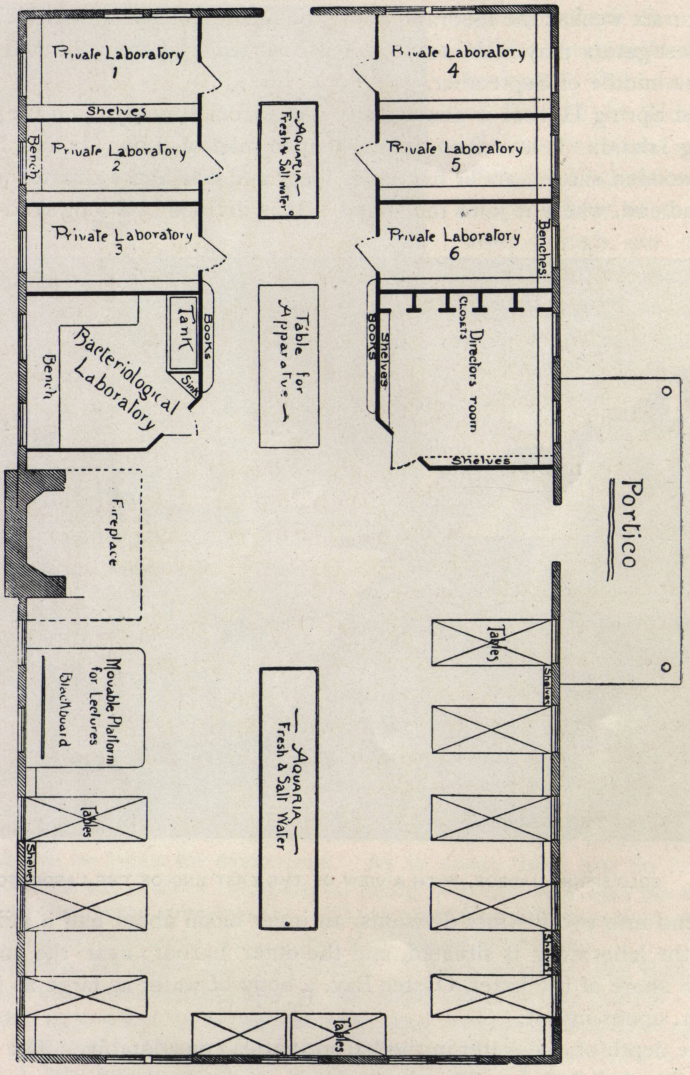


COLD SPRING HARBOR, WITH A VIEW OF THE EAST END OF THE LABORATORY.

inner end into two distinct divisions, an inner basin about half a mile long, upon which the laboratory is situated, and the outer harbor; near the middle of the western shore of the latter, Oyster Bay, a body of water as large as Cold Spring Harbor, opens into it.

The depth of the water in the harbor varies considerably. The mean range of the tide is 7.3 feet. The inner basin is gradually silting up, and exposes about half of its bottom at every low tide for an hour or so. The depth of the outer harbor, at low tide, is from 15 to 18 feet above the entrance of Oyster Bay; immediately below the entrance a long bar extends from the western shore, upon which the water is from 6 to 10 feet deep at low tide. Beyond the eastern end of this bar, which is marked by a small light-house, is a channel 72 feet deep. Outside the bar the water deepens towards the sound.

The country surrounding the harbor is hilly and well wooded. The soil is moist and vegetation in the woods is rank. At its inner end a small, clear stream, Cold Spring creek, enters the harbor. This stream, within a mile of its mouth, runs through three small, deep ponds, all of which are surrounded by heavy woods ; a portion of its course, also, is swampy.



GROUND PLAN OF THE JOHN D. JONES LABORATORY BUILDING.

The situation of the laboratory is an especially favorable one, inasmuch as in addition to the marine fauna and flora at hand, a rich fresh-water and woodland fauna and flora are also easily accessible. The harbor and the adjoining sound contains a variety of environments—marsh, mud, and sand flats, hard and soft bottom, each with its peculiar forms of life ; its waters are very rich in plankton.

The same is also true of the fresh-water ponds; deep and shallow water and marsh are present with abundant life, the plankton being very rich.

The most characteristic feature of the marine fauna is its stability. The animals found in the harbor all belong there, and have not been brought in by currents or tides from the open sea; their characteristics, consequently, have been determined by their relation to the local environment. An excellent opportunity is thus given of studying the conditions which have accompanied the development of a fauna.

The work of the laboratory is divided into several departments, which, with the instructors who have them in charge, are the following: I. Zoölogy. In this department, the following courses are given: high-school zoölogy, by Professors Davenport and S. R. Williams; comparative anatomy, by Professor H. S. Pratt; invertebrate embryology, by Dr. L. E. Griffin; entomology, by Dr. A. G. Mayer; variation and inheritance, by Professor Davenport. II. Botany. In this department the following courses are given: cryptogamic botany, by Dr. D. S. Johnson; ecology, by Mr. H. N. Whitford; bacteriology, by Professor N. F. Davis. III. Microscopical Methods, by Mrs C. B. Davenport and Professor W. L. Tower. IV. Nature Study, by Dr. H. A. Kelly. In addition to these courses, evening lectures, both of a technical and of a popular nature, occur several times a week.

The importance of excursions and collecting trips to give opportunities of studying the fauna and flora in their natural environment is fully appreciated. The laboratory has a launch and small boats with dredging and other collecting apparatus; a large oyster boat is also occasionally used; and trips to various parts of the neighboring waters are of daily occurrence. A trip is also made to Fire Island on the south shore of Long Island. Every facility is given for the collection of material for personal use and for the use of the institutions with which the members of the laboratory are connected.

A valuable feature of the laboratory at Cold Spring Harbor is the quiet and seclusion of the place. Situated a mile from the village of the same name and two miles from the railroad, it is an ideal place for work and rest. The beautiful harbor, the fine bathing beach, the excellent roads, the woods and fields, the freshwater ponds, all furnish numerous attractions to the summer visitor outside the work he accomplishes.

The laboratory building is a modern structure, 72 x 36 feet, lined inside with Georgia pine, and with excellent ventilation, due to the height of the roof; it is provided with running water, both fresh and salt, and a complete equipment. A special laboratory for investigators is also now being completed. The lecture hall is a large building lined inside with Georgia pine. The students and other members of the laboratory are housed in three dormitories, one for men, one for women, and one for married couples. The dining hall is run by the laboratory, and board is furnished at cost.

For information, application should be made to Prof. C. B. Davenport, University of Chicago, Chicago, Ill.

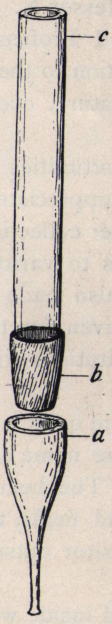
H. S. Pratt.

Haverford College.

A Method for Injecting Small Vessels.

When injecting vessels too small to use the ordinary removable cannulæ usually provided with injection syringes, it is customary to employ a small glass cannula with rubber-tube connections. This has the great objection that in order to avoid forcing air into the vessel it is necessary to fill the apparatus before it is inserted and tied. When one then attempts to insert the cannula it is very difficult to prevent the injecting mass from coming out at the tip, getting into the surrounding tissues, and so obscuring things that it is next to impossible to see what one is about; and so much time is usually consumed in the process that the mass is apt to harden and clog the opening of the cannula. To prevent this a clamp is usually placed upon the rubber tube, but even then it is far from satisfactory.

A modification of this, using the principle of the removable cannula, has been found to give very satisfactory results. A piece of glass tubing of a little larger diameter than would ordinarily be used is taken and drawn out to the desired fineness, depending upon the size of the vessel for which it is to be used. It is then cut off short so that it is much like a small funnel (*a*). The tip is flared slightly in the ordinary way to prevent the ligature from slipping. Another piece of tubing is now taken whose outside diameter is about the same as the inside diameter of the other—one that will just slip within the other nicely—and is drawn out slightly at one end and cut off so as to leave that end somewhat tapering. A short piece of rubber tubing is drawn over this tapering end (*b*), so that when it is inserted into the upper end of the cannula (*a*) it makes a perfectly tight joint. A rubber tube from the nozzle of the syringe leads to the other end (*c*) of the glass tube.



The cannula can now be inserted and ligatured. It should then be filled with some of the injection mass, either with a pipette, or by allowing it to drop in from the syringe. By using a small wire carefully it is possible to get practically all of the air out of the cannula and to get it well filled with the mass. The rubber-covered end of the tube can then be placed in the cannula and the pressure applied to the syringe, care being taken to hold the joint together tightly.

This device has all the advantages of the regular injection syringe over the glass cannula ordinarily employed, and is very simply and easily constructed.

Leon J. Cole.
Zoölogical Laboratory, University of Michigan.

The thirty-second anniversary meeting of the New Jersey State Microscopical Society occurred on March 25th. Mr. F. E. Ives of Philadelphia delivered an illustrated lecture on that occasion, his subject being "The Kromskop and Color Photography."

J. A. Kelsey, Secretary.

The Photo-Micrography of Tissues with Simple Apparatus.

The growing importance of photo-micrography has been greatly enhanced within a few years by improvements in the half-tone processes of reproducing prints; improvements which have now reached such a degree of perfection as to make the reproductions in many cases excel the originals, and this work being done at a very trifling cost, places in the hands of every microscopist ideal facilities for illustrating the result of his labors to an extended audience, provided of course he is familiar with photo-micrography, and can make micrographs of his subjects.

The appliances for doing this have kept pace with the general progress in all

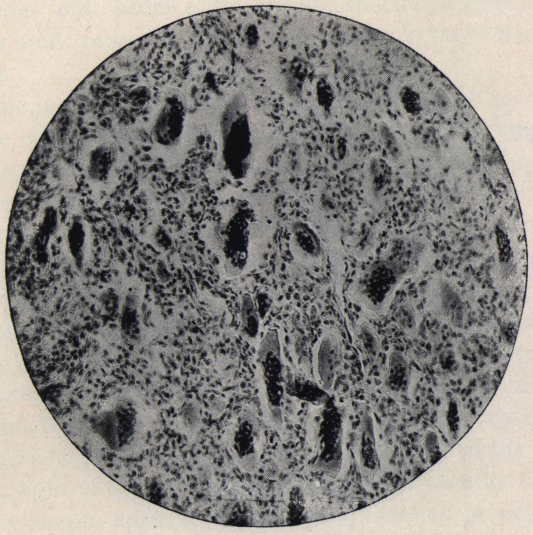


FIG. 1. GIANT CELL SARCOMA. X 100.

microscopical manipulations and technique. With homogeneous apochromatics, projection oculars, substage condensers of high numerical apertures, and stands of marvellously perfect workmanship constructed especially for the purpose, and having every conceivable convenience, it would seem that the limit of optical possibilities had been reached. If to these we add the specially designed cameras, combining in one the suggestions of many workers; orthochromatic or "color correct" plates and the many new, clearly and very perfectly developing reagents, it would likewise seem that the photographic branch of the subject has kept pace with the optical. In artificial illuminants we are equally fortunate. The electric current is almost universally available and arc lamps of great simplicity and steadiness are to be had at comparatively moderate cost. The new acetylene light, one of the most perfect of radiants for photo-micrography, is also available everywhere at no more expense than the old coal oil flame. In short, to the man with a desire for photo-micrography and a full purse, the world's

workshops are open for the supply of an unlimited amount of perfect apparatus for his purpose.

But to most students and the great mass of workers, these doors are closed. They simply have not the money to spare for such necessarily costly appliances and doubtless many turn aside in despair at the impossibility of commanding their use. But they need not. It is quite possible to do most of the work they would need with appliances already in their possession or quite within their means. The so-called student's microscope, generally in use in our colleges and high schools, usually has an inclinable stand with two eyepieces, two objectives of about 1 or 2/3 inch and 1/4 or 1/6 inch focus and an Abbe condenser. With such an instrument it is quite possible to do most excellent photographing with amplifications ranging from about 50 to 600 diameters. Very little tissue work requires over 500, while most of it may be acceptably done at 100 to 200.

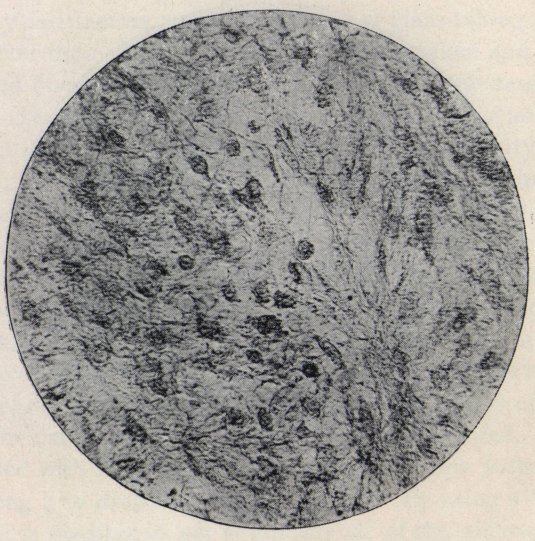


FIG. 2. MYXOMATOUS TISSUE. X 250.

All objectives of reputable makers are now so well corrected chromatically that there is little need to give the old bugaboo of focus difference consideration. Every student has such a microscope at his disposal, so we find the optical part of the question needs no further outlay.

You will probably ask, "What about the camera, this must make an extra cost?" Not at all. While very convenient and highly to be desired, good work can be done without a camera specially designed for the purpose. In fact, *any* camera provided with a focusing screen and from which the lens may be removed can be utilized in photo-micrography. A hand camera with these features is just as good for the purpose as any other form, though probably not so convenient. It merely requires to be firmly fastened to some support at such a height as to permit the tube of the microscope (when inclined to the horizontal position) to enter the lens opening and project the image of the object on the stage upon the focusing screen. The latter will be found too coarse for fine focusing, but the old

device of attaching a disk of cover glass to the ground slide with Canada balsam will offer a perfect surface for delicate focusing. A sheet of plain glass may be substituted for the focusing screen, or the ærial image may be found by means of a hand lens. The illumination may be obtained by means of a coal oil lamp standing at such a height as to bring the center of its flame up to the optical axis of the microscope.

For many years I have been profoundly impressed with the importance of photo-micrography as an educational agent which the successful introduction of the half-tone process of reproduction greatly intensified. At first the great cost of everything *necessary* for the work was no doubt a bar to its more general introduction, but happily this no longer exists. Quite recently one of a type of student's microscopes generally adopted by our best institutions of learning fell into my hands. It was a revelation to me of the wonderful progress made in the mechanism and optics of the microscope, and made my own apparatus, only some two decades old, seem quite ancient in comparison. Yet some of the objectives of my outfit represented an outlay of much more than the cost of this entire apparatus.

The microscope in question was fitted with two eyepieces, 2/3 and 1/6-inch objectives, Abbe condenser and iris diaphragm; a plain working stand, as will be seen, costing very little money but of admirable workmanship throughout.

My test of a microscope and objectives being their adaptability to photography, I proceeded to apply it to this outfit, but came a shade further than usual in discarding the use of my special camera, and making up, instead, an improvised affair, that anyone can do for himself in a very few moments. A small quarter-plate camera was pressed into the service, secured to a block at just the proper height to bring its axis in line with that of the microscope. An old focusing cloth wound around the tube of the microscope at its junction with the camera, made this light tight. A coal oil lamp with an inch flame adjustable to any height afforded the necessary illumination for most of the tests, though the far more actinic light of an acetylene flame was also used at times.

With this very simple apparatus, I made a number of negatives, mostly of tissues normal and diseased and varying in amplification from 100 to 500 diameters, the range of most useful enlargements in that class of work. While these might perhaps be exceeded in absolute perfection by the employment of the very highest attainable excellence in optical appliances, my conclusion is that they are good enough for all practical purposes, and quite within the means and ability of every student to make for himself in illustrating his own microscopical work. For this reason it is urged upon everyone to make the attempt.

Among these negatives are two which may serve to illustrate the excellence of the optical work of this microscope. Both were made by the aid of the usual Huyghenian eyepieces furnished with the instrument, a form that we are told in the books is totally unsuited to the purpose. One was made with the Abbe condenser, a form which we are likewise told is useless in photography. But negatives and prints tell a different story. It is obviously impossible to give a detailed account of their working, within the limits of space at my disposal; but a synopsis may prove useful to many seeking information on the subject.

No. 1.

Giant cell sarcoma x 100.
Object, thin section, carmin stained.
Objective, 2/3 inch, achromatic.
Ocular, ordinary Huyghenian 1 1/2 inch.
Condenser, none, flat side of flame used.
Light, Acetylene gas flame, 1 foot burner.
Plate, Seed's Non-halation.
Screen, green glass.
Exposure, six minutes (at least three times too short).
Developer, metol—quinol.

No. 2.

Myxomatous tissue x 250.
Object, very thick section, deeply stained.
Objective, 1/6-inch achromatic.
Ocular, ordinary Huyghenian 2-inch.
Condenser, Abbe, iris diaphragm.
Light, Acetylene gas flame, 1 foot burner.
Plate, Wuestner's, "Jersey Beauty."
Screen, cobalt blue (Rainig's Moderator).
Exposure, 90 seconds.
Developer, eikonogen-hydroquinone.
Prints on Velox Glossy Paper.

W. H. WALMSLEY.

COMBINED UREOMETER AND SACCHAROMETER

(IMPROVED.)

FERMENTATION TUBES FOR BACTERIOLOGIC INVESTIGATIONS OF FERMENTATION.

Further experiments with the Ureometer devised by the writer and described in the *Medical Record*, **59**: 12, 477, have shown that the evolution of gas from the decomposition of the urine by the hypobromite can be greatly facilitated by using the following modification: Instead of the test-tube for the hypobromite solution a small 50 c. c. flask is used. Twenty c. c. of the hypobromite solution are put into the flask, the urine drawn up into the pipette, which is inserted into the rubber stopper so that the end is well above the level of the hypobromite solution. One c. c. of urine is then discharged into the latter. The evolution of gas takes place at once, and the test is completed in a few minutes. The volume of air in the flask displaced by the 1 c. c. of urine is deducted from the total volume generated, and in order to avoid calculations 1 c. c. of air space should be allowed at the closed end of the graduated limb of the *U* tube and the graduations begin at zero. The accompanying illustration shows the improved ureometer.

DIRECTIONS FOR USE.—Fill the *U* tube with water to the mark *A*. In doing this, put the index finger on the end of the side-tube *d* and fill the limb *B*. By inclining the *U* tube, the water is forced into limb *C*, and any air bubbles are removed in a similar manner. As soon as the tube is filled to the mark close the free end of *B* with a cork or a rubber stopper. This prevents the water from running out through the side-tube. Put 20 c. c. of the hypobromite solution into the flask *E*, replace the double-perforated rubber stopper *g*, insert the side-tube *d* into one perforation and the pipette *f* filled with urine into the other. Remove any air bubbles from the limb *C* by inclining the apparatus, taking care that none of the hypobromite solution comes in contact with the urine. *Remove the cork from the free end of limb B.* Open the stop-cock on the pipette, allowing 1 c. c. of urine to flow into the flask. The *N* accumulates at the closed graduated limb *C*. Gentle shaking of the apparatus will greatly hasten the reaction.

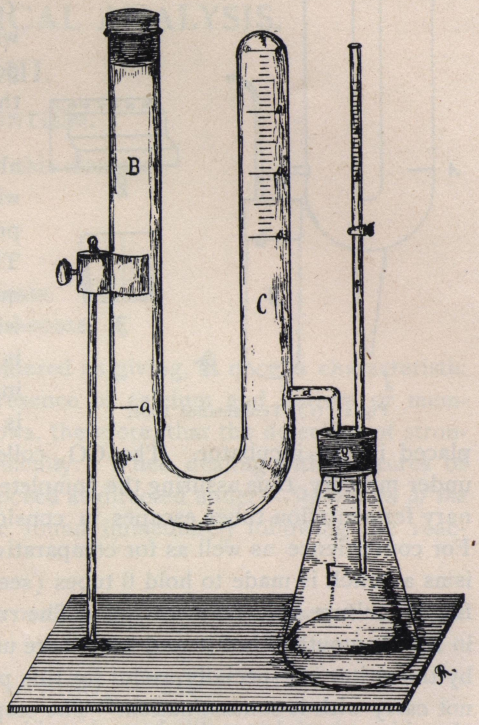


Fig. 1. Combined Ureometer and Saccharometer set up as Ureometer.

The hypobromite solution is best made up extemporaneously. The following method will be found most serviceable: Have on hand a saturated solution of sodium hydrate. Place 10 c. c. of the latter into the flask and add 1 c. c. of bromin. Shake gently until reaction is complete and add 10 c. c. of water. The writer's way of taking up the bromin will no doubt be appreciated by those who have had their Shneiderian membrane frequently exposed to the irritating vapors of this dangerous substance. We use the ordinary 1 c. c. pipette, to which a long piece of rubber tubing is attached. On the latter, somewhere near the end, is placed a small Hoffman clamp. The bromin is sucked up to the mark and the clamp at once closed tightly by means of the screw. The end of the pipette is then carried at once into the sodium hydrate solution, and the bromin discharged slowly by opening the clamp. As a safe precaution we keep open a bottle of ammonia during the operation.

To use this apparatus as a saccharometer the double-perforated stopper is replaced by one with a single perforation. The *U* tube is filled with water as described above, 10 c. c. of diabetic urine put in the flask, 1 grm. of Fleishman's yeast added, together with a small crystal of tartaric acid, and the apparatus set aside for 24 hours. The CO_2 generated will collect at the closed end of limb *C*.

FERMENTATION TUBES.—On the same principle the writer devised a fermen-

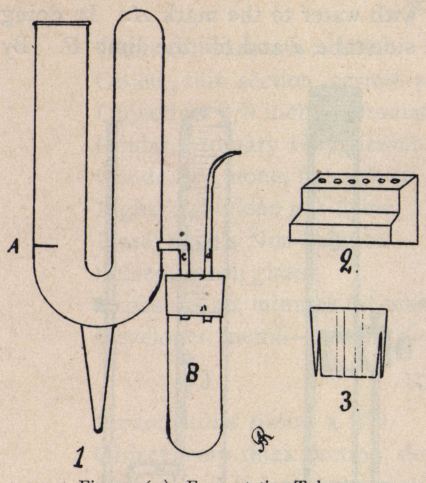


Fig. 2. (1.) Fermentation Tube.

tation tube for bacteriologic purposes. As seen from the illustration below the *U* tube is of smaller size, the stopper with a small tube drawn out to a capillary point, and a short tube used instead of the flask.

The side-tube *c* is plugged with non-absorbent cotton; the *U* tube is filled with mercury to the mark *A*, the cotton preventing the mercury from escaping. The tube *B* containing a convenient quantity of sugar-bouillon is inoculated with the organism. The rubber stopper is inserted into *B*, the displaced air escaping through *d*. This done, the end of *d* is sealed in the flame and the apparatus placed in the incubator. The CO_2 collects in the closed end of the *U* tube under mercury, thus assuring the complete collection of the gas, which in the ordinary fermentation tubes escapes in considerable quantities from the open end. For convenience as well as for comparative study of different fermenting organisms a bench is made to hold 6 tubes (see Fig. 2–2.) Only the tubes intended for the culture need be sterilized. The rubber stoppers are sterilized (in steam) in a wide-mouthed bottle and kept there until used. The rubber stopper devised by the writer is especially useful for this purpose inasmuch as its handling does not carry with it contamination. The stopper is so made that an outer jacket is formed which fits over the neck of the container, while the stopper proper is within. The illustration in Fig. 2 (3) explains itself. The writer believes that this form of stopper will be found useful wherever an ordinary stopper is used, as it offers the additional advantage of keeping out dust and preventing the escape of gas. Where the neck of the bottle is unusually thick the outer jacket is reflected while the stopper is inserted.

A. Robin, M. D.

Delaware State Board of Health Laboratory, Newark, Del.

The New Jersey State Microscopical Society.—At the February session of the N. J. S. M. S., a paper on "Pebbles" was presented by Dr. A. H. Chester, professor of mineralogy in Rutgers College.

The term "pebble" was defined as a more or less rounded piece of rock varying in size from that of a particle of sand to a boulder.

The three chief agents in the formation of pebbles are the small streams and rivers, the ocean and glaciers; the last named being by far the most important of the three.

The shape of a pebble depends upon the shape of the original fragment, and upon which of the three above named agents has produced it.

A number of lantern slides were presented illustrating glaciers chiefly, and their effects upon rocks. A large and exceedingly interesting collection of different sorts of pebbles was also placed on exhibition, the specimens ranging from the most common forms about us to gold nuggets and diamonds, sapphires and rubies in the rough—in their pebble state.

J. A. Kelsey, Secretary.

MICRO-CHEMICAL ANALYSIS.

XIII.

STRONTIUM.

We can employ, for the detection of this element:

I. Sulphuric Acid.
II. Oxalic Acid.
III. Sodium Tartrate.
IV. Ammonium Dichromate.
V. Primary Sodium Carbonate.

None of these reagents can be considered as giving, at once, a characteristic and reliable test for strontium in the presence of calcium and barium or members of the magnesium group. It follows, therefore, that the detection of strontium is often a matter of not a little difficulty. When dealing with mixtures of the alkaline earths it is necessary to proceed as directed under—*Separation of the Calcium Group*—methods which will be found immediately following the reactions for Barium.

I. Sulphuric Acid added to solutions containing salts of Strontium leads to the separation of Strontium Sulphate.

$$SrCl_2 + H_2SO_4 = SrSO_4 + 2HCl$$

Method.—To the drop to be tested add a drop of dilute sulphuric acid. A granular precipitate results. Add another large drop of the reagent, heat, and if insufficient liquid remains add more acid. The heating is continued until dense white fumes of SO_3 are given off in abundance. Allow the preparation to cool and examine at once. At first globular forms and rhombic plates appear, later, these develop into more or less irregular fusiform crystals which generally grow to crosses with two of the arms very short. Fig. 50.

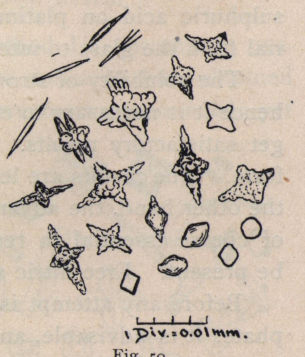


Fig. 50.

Instead of recrystallizing from sulphuric acid we can employ hydrochloric acid. If the latter method is believed to be preferable, proceed as follows: after adding the reagent in sufficient amount to insure complete precipitation, carefully draw off the supernatant solution (or filter or whirl in the centrifuge). Wash the precipitate with hot water to remove any free acid and soluble salts, then add several drops of strong hydrochloric acid. Heat the preparation to boiling, draw off, allow to cool, and examine. If after a short time no crystals separate, concentrate the solution by heating. Strontium sulphate crystallizes from hydrochloric acid in the form of square and rectangular plates, long, thin prisms, and sheaves of acicular prisms. Fig. 51.

Remarks.—As already stated under Calcium, the addition of sulphuric acid to

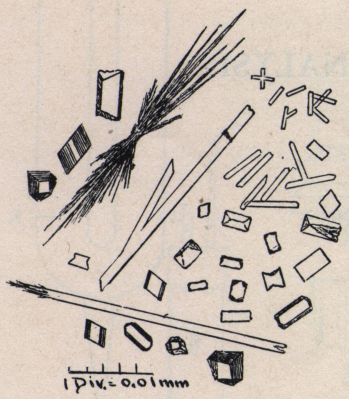


Fig. 51.

solutions containing strontium, yields bundles of needles rapidly disintegrating to merely a very fine granular precipitate. Unless the preparation is examined immediately after the addition of the reagent no acicular crystals will be seen.

If calcium is also present the grains of strontium sulphate are generally larger and often exhibit a tendency toward a spindle shape.

In all cases recourse must be had to recrystallization.

It is probable that the crystals of strontium sulphate separating from hot concentrated sulphuric acid have a composition analagous to calcium sulphate recrystallized under the same conditions.

If after a short time no crystals appear in the drop of acid, breathe on the preparation.

It is imperative that the drop to be heated be placed at the very corner of the slide, that the latter be inclined so as to keep the drop at the corner, and that the "micro" flame be applied a little to one side, and nearer the center of the slip. This procedure is necessary in order to avoid (1) the breaking of the glass slide, and (2) the spreading of the sulphuric acid. This tendency of the hot liquid to flow over the slip when it is placed in a horizontal position is so great that it is generally advisable to transfer a part of the acid to a clean slip. The transfer is accomplished by gradually raising the slip, which has been heated, until it assumes an almost vertical position and the drop has flowed to the extreme corner. The corner is then brought in contact with a clean glass slide and the drop of solution caused to flow onto the latter by means of a glass rod. In this way a clear, well rounded, deep drop is obtained in which good crystals of strontium sulphate will form.

When dealing with very minute quantities of material it is better to heat with sulphuric acid on platinum foil, since the hot acid may extract sufficient material from the glass to interfere with the reaction.

The solubility of strontium sulphate in strong hydrochloric acid is quite low, hence it is necessary to employ a considerable quantity of the solvent in order to get satisfactory results. The resulting crystals are quite small and of varied form. The results are less satisfactory than with sulphuric acid, but there is, on the other hand, the advantage that barium sulphate is insoluble in HCl. It is of course essential in recrystallizing from HCl that only traces of free H_2SO_4 be present. Free nitric acid should also be absent.

Before any attempt is made to recrystallize the precipitate of strontium sulphate, it is advisable, and usually necessary, to remove any calcium which may be present. This is accomplished by extracting the precipitate with hot water. Unless this is done, peculiar crystal forms are obtained which are difficult to interpret.

If only a small amount of barium is present, characteristic crystals of stron-

tium sulphate are obtained from hot H_2SO_4; more barium is apt to alter the usual crystal form, although the appearance of the crystals separating, still suggests the strontium sulphate type. An excess of barium seems to cause the majority of the crystals to assume forms somewhat resembling barium sulphate. In general, crystals of both strontium and barium sulphate can be distinguished in mixtures of these two elements.

Any lead which may be present will be precipitated in an amorphous condition by the dilute acid. Recrystallized from hot sulphuric acid, the lead sulphate will separate in forms which at first closely resemble those of strontium sulphate and which, later, grow to forms which may be mistaken for barium sulphate.

Recrystallized from hydrochloric acid there is less danger of confusion. If in doubt, extract the precipitated sulphates with a solution of potassium or sodium hydroxide in which lead sulphate is soluble.

As in the case of calcium, chlorides of the trivalent metals and salts of boric acid may sometimes interfere with the formation of typical crystals of strontium sulphate.

Exercises for Practice.

To a drop of a moderately dilute solution of $SrCl_2$ add dilute H_2SO_4 and examine at once.

Recrystallize $SrSO_4$ from H_2SO_4; and from HCl.

Try to recrystallize from HCl in the presence of H_2SO_4.

Make a mixture of calcium and strontium and add H_2SO_4. Recrystallize the product from H_2SO_4 without having removed the calcium. In another portion remove the calcium by extracting with boiling water and then recrystallize the residue.

See also exercises suggested under Barium.

II. Strontium Oxalate is precipitated from solutions of salts of Strontium by Oxalic Acid.

$$SrCl_2 + H_2C_2O_4 = SrC_2O_4 \cdot nH_2O + 2HCl.$$

Method.—Proceed as directed under Calcium, Method II. Strontium oxalate is precipitated at once. The crystals of this salt are similar to those obtained with calcium, but are somewhat larger and crosses are more pronounced; yet when dealing with mixtures of unknown composition, the difference is scarcely sufficient to permit of strontium being distinguished from calcium.

The crystal forms of strontium oxalate which are most frequently met with are shown in Fig. 52.

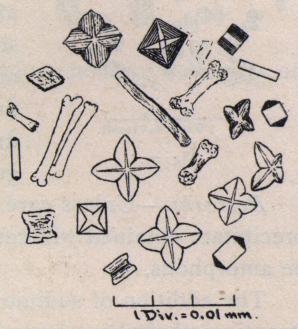


Fig. 52.

Remarks.—Either tetragonal or monoclinic crystals are obtained as in the case of calcium.

The remarks under Calcium (q. v.) apply equally well to strontium.

It is always advisable to draw off the supernatant solution and add dilute sulphuric acid to

the precipitate. If no crystals of calcium sulphate appear, add more acid, heat until white fumes appear, cool and examine the preparation for crystals of strontium sulphate (see Method I).

Exercises for Practice.

See exercises suggested under Barium.

III. With Sodium Tartrate solutions of salts of Strontium yield difficultly soluble Strontium Tartrate.

$$SrCl_2 + HNaC_4H_4O_6 = SrC_4H_4O_6 \cdot 4H_2O + NaCl + HCl.$$

Method.—Proceed as directed under Calcium, Method III. Strontium tartrate is isomorphous with calcium tartrate and is not to be distinguished from the latter (see Fig. 47). There is, perhaps, a tendency on the part of the strontium compound to form shorter and stouter prisms and thin plate-like crystals in greater abundance than is the case with the calcium salt.

Remarks.—See remarks under Calcium. It is not possible to distinguish between calcium and strontium by this test.

Behrens suggests the addition of magnesium acetate and acetic acid to the mixture thought to contain both elements, before introducing the reagent. This, he states, retards the reaction and prevents the normal development of the calcium salt while the strontium tartrate grows to its usual size. Such a modification of the test requires considerable experience in order that just the proper conditions shall be obtained; for this reason the modification is seldom successful in the hands of a beginner.

The test is useless in the presence of barium and many other elements; the most important of these being lead, iron and aluminum as chlorides, and boron as borates.

IV. Ammonium Dichromate in alkaline solution precipitates Strontium Chromate.

$$2SrCl_2 + (NH_4)_2Cr_2O_7 + 2NH_4OH = 2SrCrO_4 + 4NH_4Cl + H_2O.$$

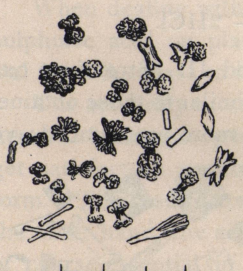


Fig. 53.

Method.—To a dilute neutral or very slightly acid solution of the substance to be tested add a fragment of ammonium dichromate (or potassium dichromate). No precipitate should result if only strontium is present. Should a precipitate result, draw off the clear liquid after all the reagent has dissolved; then add to it a small drop of ammonium hydroxide. Strontium chromate immediately separates in tiny yellow globulites or dumb-bell-like forms. Near the circumference of the drop short rods appear later (Fig. 53). Warming gently, hastens the separation.

Remarks.—Unless care is taken to employ a sufficiently dilute solution, the precipitate obtained will consist of such minute granular masses as to appear to be amorphous.

The addition of sodium acetate in excess will also cause the precipitation of strontium chromate.

Normal potassium chromate (K_2CrO_4) on the other hand, will precipitate strontium at once from neutral or slightly acid solutions, as $SrCrO_4$, in the form of slender rod-like prisms of the orthorhombic system. The crystals obtained with K_2CrO_4 are usually better than those produced by $K_2Cr_2O_7$ or $(NH_4)_2Cr_2O_7$; unfortunately barium is precipitated by both these reagents in either acid or alkaline solution. It thus becomes a decided advantage to use a dichromate in a solution acidified with acetic acid; under these conditions only barium will be precipitated, the supernatant liquid can then be drawn off, and to it ammonium hydroxide added, when strontium will be precipitated.

Salts of calcium yield no precipitate with ammonium dichromate, whether the solution be acid or alkaline.

Testing for strontium with dichromate is impossible in the presence of zinc, cadmium or the rare earths.

Lead and other elements forming insoluble chromates will be precipitated before the ammonium hydroxide is added, but may escape complete precipitation and interfere with the subsequent test for strontium.

Exercises for Practice.

See exercises and suggestions given under Barium.

V. Primary Sodium Carbonate.

This reagent precipitates, from very dilute solutions, strontium carbonate in the form of spherulites, often of considerable size.

When simple salts of the elements Ca, Sr, Ba are employed it is not at all difficult to distinguish between them by testing with primary sodium carbonate (or ammonium carbonate). A drop of the almost saturated solution of the reagent being caused to flow into the dilute neutral test drop, calcium will give well defined, highly refractive grains and rhombohedra, strontium sperulites exhibiting the usual black cross between crossed nicols, and barium, spindle shaped crystallites and fibrous masses. But if two or more of these elements are present the reaction fails, characteristic crystals being the exception.

Elements of the magnesium group must be absent.

Primary sodium carbonate is of more value as a group reagent than as an identification test.

BARIUM.

The most important reagents available for the microchemical detection of barium are as follows:

I. Sulphuric Acid.
II. Oxalic Acid.
III. Potassium Ferrocyanide.
IV. Ammonium Fluosilicate.
V. Ammonium Dichromate.
VI. Potassium Antimonyl Tartrate.
VII. Primary Sodium Carbonate or Ammonium Carbonate.

I. Sulphuric Acid added to solutions containing Barium precipitates Barium Sulphate.

$$BaCl_2 + H_2SO_4 = BaSO_4 + 2HCl.$$

Method.—Add to the test drop dilute sulphuric acid as long as any precipitate is formed; draw off, treat the residue with a large drop of the reagent, and heat until copious white fumes are given off. Cool, breathe on the preparation, and examine. Barium sulphate separates, first as tiny rectangular plates and X-shaped skeletons; then, in a short time, much larger crystallites appear with more or less feathery arms which still retain the X-form. See Fig. 54. These crystals apparently belong to the orthorhombic system.

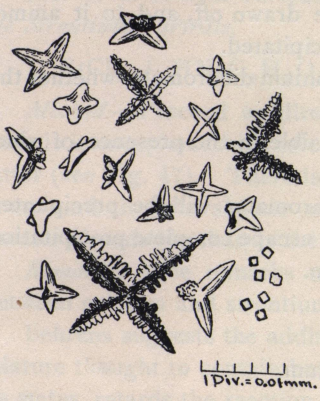


Fig. 54.

Remarks.—Owing to the low solubility of barium sulphate, a considerable amount of sulphuric acid is necessary and the preparation must be strongly heated in order to obtain a solution of the precipitate. In this operation, the precautions mentioned under Strontium must be observed.

In the event of a heavy precipitate being obtained with the reagent, it is wise to remove a small portion to another slide for recrystallization, rather than attempt to dissolve the whole mass.

Recrystallization in the presence of much calcium is to be avoided. First extract the calcium sulphate with hot water.

In the presence of moderate amounts of strontium the crystallites of barium sulphate are generally not well formed. If strontium is in excess, the crystals separating from the hot sulphuric acid have the general type of strontium sulphate, but are not well developed and exhibit an inclination to approach X-forms of barium sulphate. For this reason it is advisable to remove any strontium which may be present by repeatedly heating with hydrochloric acid, in which strontium sulphate is soluble while the barium compound remains undissolved and can then be recrystallized by heating with sulphuric acid.

Any lead sulphate which may be present will appear, first, in crystals very suggestive of strontium sulphate, then, in a short time, in larger crystallites which may at times be mistaken for barium sulphate. Treatment with hydrochloric acid or, better, with sodium hydroxide will remove the lead, leaving the barium salt unacted upon.

It is sometimes desirable to apply other tests to the precipitated sulphate in order to confirm the presence of barium. In such an event, transfer the washed precipitate to platinum foil or to a platinum cup and fuse with potassium carbonate. The fused mass is then extracted with water and the residue of barium carbonate dissolved in hydrochloric acid. This solution can then be tested for barium by any of the tests given below.

Since chlorides of the trivalent metals sometimes interfere with the formation

of characteristic crystals of barium sulphate, it is advisable to draw off the supernatant liquor after the addition of the reagent and before heating with an excess of the acid. When dealing with mixtures it is always best to proceed in this manner.

Exercises for Practice.

Try above method on a simple salt of Ba.

Make a mixture of Ca and Ba, recrystallize at once without removing the Ca. From another portion remove the Ca with hot water and recrystallize the residue.

Try a mixture of Sr and Ba. Remove the Sr by treating with HCl and recrystallize the residue.

Try a mixture of Ca, Sr, and Ba; first recrystallizing at once, then removing in turn the Ca with hot water and the Sr with HCl.

After having tried the other reactions for barium, described below, fuse some $BaSO_4$ with K_2CO_3 and proceed as directed above.

II. Oxalic Acid precipitates Barium Oxalate from solutions of salts of Barium.

$$BaCl_2 + H_2C_2O_4 = BaC_2O_4 \cdot nH_2O + 2HCl.$$

Method.—To a drop of a very dilute solution of the barium salt add sodium acetate and then oxalic acid in the same manner as in testing for calcium and strontium. In a few seconds large branching aggregates in the form of radiating bundles and sheaves of fibrous needles are seen. These radiating masses occasionally assume forms resembling snow crystals. Rarely well developed monoclinic prisms are obtained.

The usual forms of barium oxalate are shown in Fig. 55.

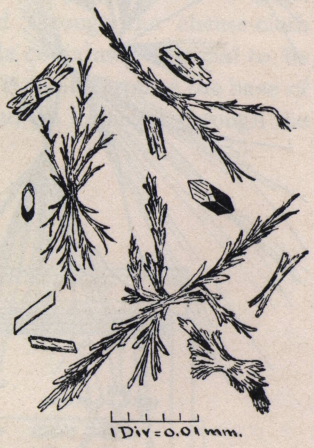


Fig. 55.

Remarks.—The solution to be tested should be neutral. A slight trace of acid is apt to prevent the separation of the characteristic crystals.

If no crystals appear after a short time, add a fragment of sodium or ammonium acetate.

When calcium or strontium are present the characteristic crystal forms of barium oxalate will not be obtained. Recourse may then be had to testing in dilute nitric acid. From nitric acid solutions the barium salt will not separate, while the oxalates of calcium and strontium will slowly crystallize in their usual form. After allowing sufficient time for the complete separation of calcium and strontium, draw off, concentrate the solution, and add sodium acetate. Barium oxalate now appears, usually in the form of rosettes of thin prisms.

Barium oxalate, like the oxalates of calcium and strontium, assumes different crystal forms according as the test drop is hot or cold. Hot solutions give rise to the production of strongly polarizing orthorhombic plates.

Since, in order to facilitate the separation of barium oxalate, sodium acetate

has been added, it is well to bear in mind that there is danger of interference from members of the magnesium group.

Boric acid present in the test drop may prevent the formation of characteristic crystals of barium oxalate.

Although chlorides of iron and aluminum have, as has been stated, no deleterious influence on the precipitation of the oxalates of calcium and strontium, we meet in the case of barium with a most interesting and remarkable reaction. Owing to the formation of a double oxalate, instead of the forms shown in Fig. 55, there are now obtained tufts and bunches of very long, fine, curving, hair-like crystals of exceedingly characteristic appearance. The chemical composition and formula of this compound is not yet clear. In order to obtain this interesting compound, proceed as follows: To the test drop containing barium, add ferric chloride in sufficient amount to impart a faint but distinct yellow color; then add a fragment or two of sodium or ammonium acetate; stir. The yellow should now have changed to a reddish tint. Into the drop thus prepared cause a drop of oxalic acid to flow. Tufts and sheaves of very fine needles soon appear. The needles rapidly grow longer and longer and soon begin to curve in a most peculiar manner. See Fig. 56. The presence of calcium or strontium, or both, in even large amount does not appear to have any serious influence on the formation of this double oxalate of barium and iron, save that its separation is often somewhat retarded. In such mixtures the oxalates of calcium and strontium first appear in their usual form, then after a time the hair-like tufts of the double oxalate appear. If the quantity of barium is quite small, little rosettes of radiating needles are obtained, separating near the edges of the drop.

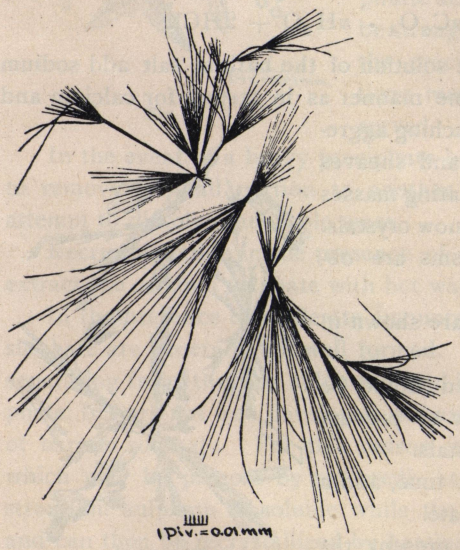


Fig. 56.

Aluminum gives rise to the formation of a similar product, but the crystal masses are colorless, while those of the iron salt are light brown.

Chlorplatinic acid interferes with the formation of barium oxalate in a manner similar to iron and aluminum. Hence it is inadvisable to test a preparation with oxalic acid for borium, which has already been tested for potassium.

For a list of the elements with which oxalic acid may give a crystalline precipitate, see the list of reagents*.

Exercises for Practice.

Try the reaction of oxalic acid on salts of Ca, Sr, Ba, in neutal solution, first

*Jour. App. Micros. III, 818.

cold then hot. Draw off the mother liquor and test the precipitate with H_2SO_4.

Try the three elements in test drops acidulated with nitric acid. To the drop from which barium oxalate does not separate add sodium acetate.

Try oxalic acid on a salt of magnesium, then add an excess of acetic acid to the test drop and examine again.

Test salts of Zn, Cd, and Pb.

Make a mixture of Ca, Sr, Ba. Add $H_2C_2O_4$. Repeat the experiment in HNO_3 solution; after a few moments, draw off the clear solution, concentrate slightly and add sodium acetate.

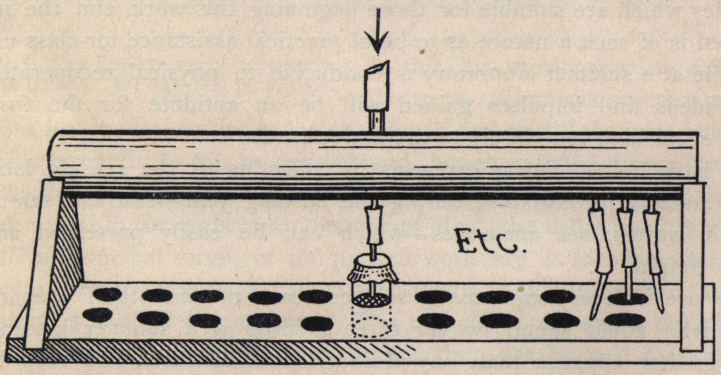
Try the effect of the presence of ferric chloride on the precipitation of the oxalates of Ca, Sr, Ba; first each element separately, then in mixtures of Ca and Ba; Sr and Ba; Ca, Sr, Ba.

If barium borate is at hand, try testing it for Ba.

E. M. CHAMOT.
Cornell University.

Simple Washing Device.

A copper tube twenty-four inches long and two inches in diameter, placed horizontally, is connected with the faucet through a half-inch tube let in midway above. The ends are closed. Below are let in twenty quarter-inch pipes one inch long. Over these are slipped rubber tubes, each carrying a nozzle of glass brought nearly to a point. The nozzle is pushed through the cheese-cloth fastened by rubber bands over the mouth of the bottle containing material to be washed. The bottle is made to stand in a hole in the plank forming the base of the support for the main pipe. The water then turned on descends through the



twenty feed-pipes, washing through any bottles which may be set into the apparatus. The whole arrangement stands in the sink. No pinch-cocks are needed for feed-pipes not in use.

The apparatus was designed by Mr. Ames, is not expensive, and proves very handy.

The bottles used and to be highly recommended are "sample-tubes" of rather thick glass, straight all the way up, two and three-fourths by one and one-fourth inches. Material is carried in the same bottle without removal, from collection up to the paraffin bath.

ROBERT G. LEAVITT.
Ames Laboratory, North Easton, Mass.

Journal of
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and
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Edited by L. B. ELLIOTT.

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SEASIDE, lakeside, and field laboratories will soon open, and, judging from the preparations being made, the attendance this year will be larger and more representative than ever. It is interesting to note in this connection the progress which has recently been made in the establishment and expansion of summer laboratories. It is but a few years since Agassiz and his pupils began their investigations in the extremely unpretentious laboratory at Penikese. The coming season will find well equipped laboratories, easily accessible from all parts of the country, with hundreds of teachers and students, many of them entering for the first time into the real spirit of research work and gaining a clearer view of the possibilities for development in their own laboratories, where of necessity the most time is to be spent.

The opportunity to come in personal contact with the various forms of life in their native places, to study them under these most favorable conditions with the assistance of experienced and enthusiastic instructors, and to meet as co-laborers a similarly interested company, is one which ought to be taken advantage of by every teacher of biological science, especially since the cost is made so very moderate. Specially prepared short courses are now offered at most of the laboratories which are suitable for those beginning this work, and the information gained is of such a nature as to be of practical assistance for class use.

The life at a summer laboratory is conducive to physical recuperation, and the new ideas and impulses gained will be an antidote for the fossilizing tendency of sticking too closely to the native heath.

Some have helped defray expenses by collecting at the seaside laboratory sufficient material for class use during the ensuing year—star fish, sea urchins, crustaceas, worms, sea anemones—which can be easily preserved and sent inland by freight.

There are in every state many science teachers and others preparing for teaching who could spend two or three months at a summer laboratory at scarcely greater expense than any ordinary vacation costs, and reap benefits which could be had in no other way. No doubt many who would spend the summer vacation at some laboratory, do not do so from a lack of confidence in the practical value *to them* of the work and an exaggerated idea of the expense involved. We would suggest in such instances correspondence with the directors of the various laboratories.

CURRENT BOTANICAL LITERATURE.

CHARLES J. CHAMBERLAIN.

Books for review and separates of papers on botanical subjects should be sent to Charles J. Chamberlain, University of Chicago, Chicago, Ill.

REVIEWS.

Grout, A. J. Mosses with a Hand-lens. 8vo, pp. xi + 74, 1900. Published by the author, 360 Lenox Road, Flatbush, New York City.

This convenient little book certainly supplies a long felt need. It is a non-technical handbook of the more common and more easily recognized mosses of the Northeastern United States. Two general keys are given, one based mainly upon structural characters and the other based mainly upon habitat. With the aid of these keys, the descriptions and Miss Thayer's numerous excellent illustrations, the student is enabled to recognize about one hundred mosses. An illustrated glossary of bryological terms is an important feature. It is a matter of common observation that experienced bryologists make a liberal use of the hand-lens, while beginners are much more dependent upon the compound microscope. All who would become familiar with the mosses are indebted to the author for the clear presentation of those characters which will enable one to recognize so many forms in the field without the necessity of bringing them to the laboratory and making mounts for the compound microscope. However, it is very probable that a student who uses this little book will soon find his interest increasing and will be led to use the more extended and technical works which would never have attracted him at the beginning.

C. J. C.

Campbell, D. H. The Embryo-sac of Peperomia. Annals of Botany. **15**: 103–118, pl. 6, 1901.

In this, his third paper on *Peperomia*, the writer acknowledges that some of his previous interpretations must be abandoned and that Johnson's results are substantially correct. It will be remembered, however, that Johnson confirmed the most important point in Dr. Campbell's preliminary paper, namely, that there are sixteen nuclei in the embryo-sac instead of eight, the usual number in angiosperms. The principal results of the present work are as follows: All species of *Peperomia* seem to agree in having sixteen nuclei in the embryo-sac, and there is no polarity as in other angiosperms. The egg cell is somewhat differentiated by an accumulation of cytoplasm about it, but there are no well marked synergids. Several (usually eight) nuclei fuse to form the endosperm nucleus. These are regarded as homologues of the polar nuclei of typical angiosperms. One of the male nuclei from the pollen tube fuses with the egg nucleus, but the fate of the other male nucleus could not be determined. The embryo is small and shows no differentiation into organs when the seed is ripe. The divisions of the endosperm nuclei are always accompanied by the formation of cell walls.

The writer still believes that the embryo-sac of *Peperomia* represents a primitive condition and that the presence of sixteen nuclei is not a derived feature.

He agrees with Johnson and Strasburger in not regarding the fusion of polar nuclei as a sexual process, but merely a physiological phenomenon. The whole endosperm as well as the antipodal cells are regarded as gametophytic structures. *Gnetum*, as described by Lotsy, furnishes the nearest approach to the embryo-sac structures of *Peperomia*.

The author had several species of *Peperomia* germinated at Kew and they proved to be genuine Dicotyledons. Attention is called to significant resemblances to the lower Monocotyledons, especially the Araceæ. The conclusion is reached that *Peperomia* is the most primitive type of the Dicotyledons and that the resemblances between the Piperaceæ and lower Monocotyledons suggests that the divergence of the two groups may have occurred very early.

C. J. C.

Timberlake, H. G. Swarm Spore Formation in Hydrodictyon utriculatum Roth. Bot. Gaz. **31**: 203, 1901.

In this short preliminary note Prof. Timberlake announces some interesting results of his work on *Hydrodictyon*. Material was fixed in a fluid recommended by Eisen.

(1) Iridium chloride (0.5 per cent. aqueous solution) - 100 c. c.
Glacial acetic acid, - - - - - - - - - - - - - 1 c. c.
(2) Iridium chloride (1 per cent. aqueous solution) - - 100 c. c.
Glacial acetic acid, - - - - - - - - - - - - - 3 c. c.

The second solution gave better results. There are no differentiated chromatophores, but the chlorophyll is distributed throughout the cytoplasm. The nuclei have the structure of those of higher plants. When the segments of older nets are to give rise to swarm spores, cleavage furrows are run in, at first cutting out large multinucleated portions of cytoplasm, which are then divided and subdivided until each mass contains only a single nucleus. Each mass then gives rise to a single uninucleated, biciliated spore. C. J. C.

Palisa, J. Die Entwickelungsgeschichte der Regenerationsknospen, welche an den Grundstücken isolirter Wedel von Cystopteris-Arten entstehen. Ber. d. deutsch. bot. Gesell, **18**: 398–410, pl. 14, 1900.

Among many ferns the power of regeneration has long been known. Heinreicher, in studying the resistance of adventitious buds of *Cystopteris bulbifera* to draught, found that after the central apical part of the bud had decayed, small plantlets often arose from the outer parts, and he ascertained by experiments that they arose from the bud-scales. He also found that similar buds arose from the basal part of the fronds of other ferns. The developmental history of the adventitious buds of *Cystopteris* and other ferns has been determined by Heinreicher, and in the present article Palisa gives an account of the development of these regeneration buds. He worked mainly on two forms, *Cystopteris bulbifera* and *C. montana*. On the former, the buds arise from the outer scales of the adventitious buds, and on the latter from the basal portion of the fronds. The scales of the former were removed and placed in moist sand under glass tubes, while in the latter case the formation of buds was invoked by cutting off from the underground rhizome the still unrolled frond blade.

Palisa endeavored to answer two questions ; first, are there any predetermined

cells from which the buds arise? Of four hundred scale leaves tried, over half regenerated. The location of the regeneration buds was mostly on the flanks at the leaf base. On older scales there is a greater tendency for the buds to appear on the median line of the scale. If the scale be divided in two by a cross section, regeneration only occurs from the basal half. The power of regeneration diminishes with the distance from the leaf base. Many bud *primordia* may start together and only one survive. If a *primordial* outgrowth be removed by cutting, then numerous primordia arise about the margin of the cut surface. No anatomical difference could be noticed between the epidermal cells from which the buds arise, and the adjoining ones, and Palisa concludes that they may arise from any of the epidermal cells.

The second question concerns the development of the buds. They always arise from a group of epidermal cells. Sections through the scales show the hypodermal cells to take no part whatever in the development. The first appearance is a dome-shaped elevation on the surface, which soon becomes prominent above the surrounding tissue. The outline of the original epidermal cells remains quite distinct after many divisions have occurred. When the outgrowth reaches a considerable size, an apical cell is organized and further growth proceeds from it. From its segment the frond is formed and from the lower part of the frond the roots spring. In the case of outgrowths which arise later and are more scattered and thus have more space, the growth from each epidermal cell may organize an apical cell and originate a bud. Between these methods there is every stage of gradation. A number of apical cells may start, close to one another, but one usually develops more rapidly than the rest, draws the nourishment from them, and they cease to function.

Palisa compares the developmental history of these buds with that of the normal adventitious buds which always arise from a single epidermal cell.

Chicago. W. B. MacCallum.

CYTOLOGY, EMBRYOLOGY, AND MICROSCOPICAL METHODS.

Agnes M. Claypole.

Separates of papers and books on animal biology should be sent for review to
Agnes M. Claypole, Sage College,
Ithaca, N. Y.

CURRENT LITERATURE.

Nussbaum, J., u. Prymak, T. Zur Entwickelungsgeschichte der eymphoiden Elemente der Thymus bei den Knochenfischen. Anat. Anz. **19**: 6–19, 1901.

This work demonstrates that the leucocytes of the thymus in bony fishes arise largely if not entirely from the epithelium; this is a point of very general significance in regard to the germ layer origin of the lymphoid elements. The special point of interest and importance is the entire harmony of this work with that of J. Beard reviewed in March, 1901, of the Journal of Applied Microscopy and Laboratory Methods. A. M. C.

Eismond, J. Ueber die Natur der Sogenannten Kinetischen Centren der Zellen. Anat. Anz. Centralblt. für die Gesammte Wiss. Anat. Ergänz. **18**: 125–141, 1900.

The question of the significance of the centrosome is one of the most prominent among the cytological problems of the present day; recently it is especially considered in reference to cell mechanism as it shows itself to be of importance in this connection. The view generally held is that the centrosomes are a distinct, granular, primary element of the cell, a permanent part of the cell, and like the nucleus multiplying by self-division. Opposed to this is the view of possible spontaneous origin of centrosomes. At the same time it is possible the centrosome may be a cell-organ, having to do primarily with the processes of division. Many authors say that the centrosome collects around itself a specially active kind of protoplasm—kinoplasm—and permeates this in the form of the different achromatic threads of the nuclear division figures. Further work has developed the resemblances between this "cell organ" and basal bodies in ciliated cells and the blepharoplasts in the plant antherozoid. The question is still whether the centrosome, the middle-piece of the spermatozoan, the blepharoplasts and the basal bodies are truly kinetic centers of the cell; whether they originate the power for such kinetic process.

Previous work by the author has developed the view that the centrosome is not a pre-formed organ in the cell, multiplying by division, but, at least in embryonic cells, more likely arises *de novo* and persists until changes enter into the cell-mechanism to destroy the mechanical reasons for its existence. Comparing the "kinoplasmic fibers" of the mitotic figures, in so far as they actually show distinctly differentiated parts of the plasmatic network, with the radiating fibers of pigment cell and the "muscle-threads" of the protozoan, compels the opinion that these structures are somewhat similar. The special character of the muscle-threads as a peculiar elastic structure acts to make them not cause contraction, but keep the body-form of the animal by their elastic property. Proof of elasticity, not contractility, lies in the effect of reagents on these fibers. The axial fibers coil spirally. The comparable nature of the elastic supporting apparatus of Heliozoa and tissue cells can be stated as follows: In embryonal cells there is, as in some tissue cells (pigment) and protozoa (Heliozoa), a permanent structure which forms a support for the cell-mechanism and can be considered an elastic cyto-skeleton. Considering the centrosome of embryonic cells in this connection, the cause for division is apparent. The centrosome is the inert central knot of this elastic skeleton and must be divided by the division of the cell body. It is a passive division. The evidence from Schaudinn's work on *Ancanthocystis aculeata* shows clearly the origin of the centrosome in the new cells, no division of the original centrosome takes place. The great variations in the form of the centrosome, from small central granules to large, irregular axes as long as the cell, or as vacuolated vesicles, support the *de novo* view, and show that the kinoplasmic apparatus near the centrosome is in general a supportive structure, whose center has different space relations according to the mechanical conditions involved.

The basal bodies of ciliated cells are next considered. Cilia in most cases have no power of independent motion, but are passive, often stiff cell appendages.

Hence the motive force lies outside these structures. The structures are compared with the supporting bones of a fish's fin, and a comparison is made to bring out the resemblances caused, of course, by the similar mechanical conditions. Finally, the author states his belief, that the ciliated cell apparatus, the supportive structures of the mouth cirri of amphioxus and the blepharoplasts of antherozoids are all similar structures. A. M. C.

Regaud, Cl. Quelques détails sur la division amitotique des Noyaux de Sertoli chez le rat. Sort du nucléole Deux variétés d'amitose: Équivalence ou non-équivalence des noyaux fils.
Anat. Anz. Centralblatt f. d. Gesammte Wissen. Anatomie. Ergänzungsheft zum xvii Bd., 1900, p. 110–124, 15 fig. im text.

In 1899 several articles were published by the same author to show that the cells of Sertoli do not play simply a nutritive role for sperm cells, but are cells capable of amitotic division, and hence of producing spermatogonia. The evidence for this is based not only on the nuclear figures clearly amitotic, but also on observations on the stages of development of the spermatogonia and on transition forms of nuclei between those of the Sertoli cell and the spermatogonia; finally on the impossibility of explaining the renewal of spermatogonia by the karyokinesis of the other cells present. The method used for the study of chromatic parts of the seminal epithelium, is a double stain of hæmatoxylin and safranin. This process gives very good results after fixation in Baum's picro aceto-formol mixture, and Lenshossék's of sublimate alcohol and acetic acid. The most exact results follow the use of Tellyesniczky's bichromate of potash and acetic acid. The sections are stained rather deeply with alum hæmatoxylin, then washed in water. If the sections appear too deeply colored under an immersion lens in water without a cover glass, decolorization follows with an aqueous solution of formic acid (1–100). Washing in ordinary water restores the blue color. After this the sections are stained for twenty-four hours or more in Zwaardemaker's solution of safranin. A rapid washing in water is followed by decolorizing in ninety per cent. weakly acidulated alcohol (1 HCl–1000 Alc.). The safranin is removed, but the hæmatoxylin is unaffected: neutral ninety per cent. alcohol is followed by absolute and then xylol and Canada balsam. If the two stains have acted with just equal intensity, a condition easily obtained by practice, the cytoplasm is stained a pale rose-violet and the chromatic parts are very intensely colored, sometimes a purple-violet, sometimes a red-purple, sometimes intermediate between these colors. The chromatic granules in the accessory nucleolus of the nucleus of the Sertoli cells, the surface chromatin of the spermatogonia and young spermatocytes, the chromatin of the nuclear mass of the spermatocyte during the first part of their development, the nucleus of the spermatids during first period of their transformation into spermatozoa, are all colored a violet-purple. The extra nuclear chromatic bodies of the spermatocyte and spermatid, the nucleolus of the nucleus of Sertoli cells, certain parts of the nuclear chromatin of the spermatocyte (body of Lenshossék at certain stages), the nucleolus of the spermatocyte, the nucleus of the spermatid during the last period of transformation, etc., are colored a red-purple. Intermediate between these are certain chromatic bodies of the young spermatogonia and the chromatin of the nuclear filament of the spermatocyte in certain stages. During the karyokinesis of spermatogonia their

chromatin is a violet-purple; during the karyokinesis of the spermatocytes their chromatin is always a red-purple. The author sums up his results as follows:

1. The amitotic division of the nucleus, which in most cases indicates a degeneration of the cells, does not always show the approach of final degeneration. The nuclei of the Sertoli cells divide a considerable number of times, perhaps indefinitely, by amitosis. The spermatogonia resulting from amitosis are the founders of a line of cells which show ultimately more karyokinesis and finally develop into spermatozoa.

2. Amitosis in the case noted is the same as that in many others; a phenomenon of the nucleus only, without an immediate division of the protoplasm. Much later the protoplasm divides.

3. The nucleolus of the Sertoli cell appears to be a cellular organ of primary importance, it is possibly the carrier of a reserve of hereditary substance.

4. It is remarkable that the nuclei of the Sertoli cells, the stem nuclei which carry the determinants (Weissmann) of the species, are really the poorest in chromatin of all the nuclei of the germinal epithelium. The quantity of chromatin which passes into the nucleus of the spermatogonia is infinitesimal in comparison with that contained by the spermatocyte at the moment of karyokinesis. The chromatin of the spermatocyte is then acquired, at least in its mass, and is not hereditary. A. M. C.

NORMAL AND PATHOLOGICAL HISTOLOGY.

JOSEPH H. PRATT.

Harvard University Medical School, Boston, Mass., to whom all books and papers on these subjects should be sent for review.

Ewing, J. Malarial Parasitology. Journal of Experimental Medicine, **5**: 429–491, 1901.

Recent advances in our knowledge of the morphology of the malarial parasites have been largely due to improved staining methods. Ewing restricts the use of fresh blood to the study of various vital phenomena in the parasite, such as amœboid movement, vibratory motion of pigment, and ex-flagellation. The discovery of parasites is so much more certain and rapid in stained dry specimens that a negative result with fresh blood invariably requires verification by search through a dry specimen, stained preferably by Nocht's method.

For all ordinary purposes staining by eosin and methylen blue is recommended. The solutions used are: (a) a saturated alcoholic solution of alcoholic eosin diluted with an equal quantity of 95 per cent. alcohol, and (b) a saturated watery solution of Ehrlich's rectified methylen blue at least one week old.

Methylen blue does not stain the young ring forms well. For this purpose Nocht's method is especially useful. The method of Benario and Marchoux as modified by Futcher and Lazear is also of value, as the rings are densely stained and the preparations are permanent. It is employed as follows: Fix the specimens five minutes in 95 per cent. alcohol, 100 c. c., to which has been added

1 c. c. of formalin. Stain one to three minutes in the following mixture: saturated alcoholic solution thionin, 20 c. c., 20 per cent. carbolic acid, 100 c. c. The fixing solution must be fresh, and the staining fluid at least one week old.

Nocht's modification of Romanowsky's method consists in the addition of a few drops of neutralized Unna's polychrome methylen blue (Grübler) to the 1 per cent. solution of ordinary methylen blue. The author obtained uniformly good results by the following procedure: (1) To 1 oz. of polychrome methylen blue (Grübler) add 5 drops of 3 per cent. solution of acetic acid (U. S. P. 33 per cent). (2) Make a saturated (1 per cent.) watery solution of methylen blue, preferably Ehrlich's rect. (Grübler), or Koch's, dissolving the dye by gentle heat. This solution improves by age, and should be at least one week old. (3) Make a 1 per cent. solution in water of Grübler's aqueous eosin. The mixture is prepared as follows: To 10 c. c. of water add 4 drops of the eosin solution, 6 drops of the neutralized polychrome methylen blue, and 2 drops of 1 per cent. methylen blue, mixing well. The specimens, fixed in alcohol or by heat, are immersed for two hours, specimen side down, and will not overstain in 24 hours. The red corpuscles are stained light pink, the body of the parasite blue, while the chromatin particles of the nucleus appear deep red.

Nocht's procedure is also of value in studying the nuclear structures in other micro-organisms.

Goldhorn (N. Y. Path. Soc., Feb. 13, 1901) has succeeded in increasing the amount of the red staining principle by digesting polychrome methylen blue with lithium carbonate. He stains the specimen for a few seconds in 0.1 per cent. watery solution of eosin, then in digested polychrome blue 30 to 60 seconds.

Ewing found no evidence for the view that there is more than one species of the æstivo-autumnal parasite. The nucleus of the malarial parasite belongs to the "distributed type" of protozoan nuclei, consisting of granules of chromatin. While not a true nucleus in the metazoan sense, it possesses all the nuclear structures required in some protozoa. He believes that conjugation of malarial parasites occurs. His observations seem to him to admit of no other explanation; but he does not regard conjugation as an essential feature of the growth of the parasite. He regards the existence of several species of malarial parasites as not yet proven, and adheres to the theory that there is a single polymorphous species. J. H. P.

Rosenberger, R. C. A New Blood Stain. Philadelphia Medical Journal, **7**: 448, 1901.

Rosenberger discovered that phloxin stains the granules of the leucocytes remarkably well. He recommends the following solution as a differential stain for the cells in the blood:

Saturated aqueous solution of methylen blue,	5 parts
Saturated aqueous solution of phloxin,	2 parts
Alcohol (95 per cent.),	3 parts
Distilled water,	6 parts

These are mixed together. A precipitate generally forms. The stain should be well shaken before using. It works well after fixation by heat, alcohol and ether, or absolute alcohol. Stain one to four minutes, wash freely, dry, mount in balsam. J. H. P.

Baum, E. Ueber die punktförmigen Kalkkörperchen (sogen verkalkte Glomerule) der Nierenrinde. Virchow's Archiv, **162**: 85–93, 1900.

The yellowish-white points sometimes seen on the surface of the kidney have been regarded as calcified glomeruli. In the great majority of cases they are not glomeruli, but cysts containing lime-salts. These cysts are of two kinds. They are present in kidneys in which there is no evidence of chronic interstitial changes. The larger, irregularly shaped cysts arise from the uriniferous tubules. Their walls are lined in places with high epithelium. The cysts of the other variety are round, about the size of a glomerulus and confined to the cortex. They represent capsular spores of malpighian corpuscles, in which glomeruli have not developed. The lining epithelium when present is of a low type. The lime is deposited in the colloid material which fills the cysts. The lime occurs as small granules and as concentric masses. Only rarely does a sclerosed glomerulus become calcified. J. H. P.

Whitney, W. F. A Quick and Simple Method for Fixing the Blood Corpuscles for Differential Staining. Jour. Boston Soc. Med. Sci. **5**: 341, 1901.

The writer states that the various methods for the rapid fixation of blood smears that have been devised are all uncertain. The method has given uniformly good results. It consists simply in the use of a modified Zenker's fluid. This solution consists of a mixture of potassium bichromate two parts, sodium sulphate one part, water 100 parts, saturated with corrosive sublimate, plus 5 per cent. of glacial acetic acid. In Whitney's modification 5 per cent. of strong nitric acid is substituted for the 5 per cent. of acetic acid.

The blood is drawn and spread in the usual way and dried thoroughly in the air or, if preferred, by a gentle heat. The cover-glass is taken with the forceps, the prepared surface covered with a few drops of the fluid and held while twenty are counted slowly. It is washed off with running water and blotted. The action depends upon the combination of corrosive sublimate with potassium nitrate and chromic acid which are formed in the solution.

Ehrlich's triacid stain, Unna's polychrome methylen blue and Chenzinski's eosin work well after the fixation. J. H. P.

Goldhorn, L. B. A Rapid Method of Staining the Chromatin of the Malaria Parasite. Med. Rec. **59**: 11.

1. Fix fresh preparation by immersion in pure methyl alcohol for 15 seconds.
2. Wash in running water.
3. Stain for 7 to 30 seconds in 0.1 per cent. aq. sol. of eosin.
4. Wash in running water.
5. Stain for 30 to 60 seconds in polychrome solution.
6. Wash again and dry in air; no filter paper or heat being used.

If, on exposure to air, the dye becomes too alkaline, a few drops of a 4–5 per cent. solution of acetic acid may be added. If this amount of acid proves too much, add a few drops of a saturated aqueous solution of lithium carbonate. The stain improves on keeping. C. W. J.

GENERAL PHYSIOLOGY.

RAYMOND PEARL.

Books and papers for review should be sent to Raymond Pearl, Zoölogical Laboratory, University of Michigan, Ann Arbor, Mich.

Schenck, F. Physiologische Charakeristik der Zelle. Würzburg, A. Stuber's Verlag (C. Kabitzsch). 8vo, pp. viii and 123, 1899.

This work aims to determine in how far the cell may be considered a "physiological unit" or "elemental organism," and, having settled this point, to examine the real physiological significance of the cell and its parts. The method taken is a critical examination and analysis of a considerable part of the important literature bearing on the subject. The author is strongly opposed to the view that the cell presents the simplest condition of life phenomena, and that a physiological study of the cell ought to precede, and form a basis for the "organ physiology" of higher animals. Nearly a third of the book is occupied with a criticism of this view, the criticism being mainly directed towards Verworn. The principal points made in this portion of the work are: 1. That all cells are not capable of independent existence and hence are not physiological individuals. 2. That since some multicellular forms *are* physiological individuals, this sort of individuality must be independent of the formation of the organism out of cells. 3. That in a multicellular organism the cells are in organic connection with one another by means of protoplasmic strands and that, therefore, the whole must be considered as the individual. 4. That the study of the contraction phenomena in unicellular animals does not lead to any better understanding of the contractility of muscle, and furthermore that, in all probability, the phenomena are simpler and lend themselves more readily to analysis in the latter than in the former case.

The more distinctly constructive contributions have as their purpose to find whether the whole cell or only parts of it are necessary in the carrying on of the fundamental life processes. These processes are discussed under four heads. The first to be considered is the relation of the cell to "physiological combustion" or oxidation, and to the phenomena which primarily depend upon the oxidation of the living substance. The author makes citations from the literature which show, according to his belief, that movement, processes of dissimilation, electrical phenomena, irritability, etc., may take place in enucleated cell fragments. He concludes that "physiological combustion" does not depend upon the combined action of all the parts of the cell, and, therefore, that so far as this process is concerned the cellular structure of the organism is without significance. The next processes to be considered are those of assimilation, growth and morphogenesis. The point brought out here is that, while enucleated protoplasm is capable to some slight extent of carrying on the processes of assimilation, growth and regeneration, yet these processes can only go on continuously when both the characteristic cell parts, nucleus and cytoplasm, act together. It is maintained, however, that the cell is dependent in its formative activity on the whole organism of which it is a part. The division of labor between nucleus and cytoplasm

is the next topic discussed. It is believed that the cytoplasm has to do primarily with the relation of the organism to the external environment, i. e., with the reactions to stimuli; while, on the other hand, the nucleus, as a result of its assimilatory activity which conditions growth and reparation, enables the organism to continue living. In this section the author offers some very interesting and suggestive theories as to the physiological significance of the division of organism into cells, and the phylogenetic origin of the nucleus. In a short section on cell and nuclear division it is maintained that the centrosome is the part of the cell essentially concerned with these processes.

In concluding, Schenck condemns the view that "cell physiology" is synonymous with "general physiology," and even considers that the attention which has been paid to the former has tended to hinder the progress of the latter. The work is throughout one of interest, and in many respects, of value. The style is uncommonly clear and straightforward. The thing which most mars the work is the polemic character which pervades the whole and at times descends to absurd personalities. R. P.

Cole, L. J. Notes on the Habits of Pycnogonids. Biol. Bull. **2**: 195-207, 1901.

This paper, although brief, furnishes an important contribution to our knowledge of the general physiology of the somewhat neglected group, the Pycnogonida. The principal points treated are the movements and the reactions to light, both of which are described in detail. Two curious facts brought to light in connection with the movements are: (a) the action of the legs is precisely the same in both the swimming and crawling movements; and (b) the stroke of the anterior legs is found to be stronger than that of the posterior, and, since the action of both is qualitatively the same, it results from the structural relations of the body that the posterior legs act as hindrance to forward movement when the animal is crawling. The pycnogonids studied are shown to be positively phototactic, but the precise form of the orientation differs according as the animal swims or crawls. When *crawling* towards the light the anterior end of the body precedes, while when *swimming* towards the light the posterior end is in advance. The reaction is the same in the two cases, but the result is conditioned by the mechanical relations of the animal to a solid object, i. e., the bottom. This point is of considerable theoretical interest as indicating that the essential thing in an orientation is not the getting of one end of the organism towards or away from the source of the stimulus, but is, on the contrary, the placing of the axes of the body in definite relations to the lines of action of the directive stimulus. The transfer of the eggs from the female to the male was observed and found to be a comparatively simple process, apparently involving no psychic activity on the part of the animals. R. P.

Ritter, W. E., and Congdon, Edna M. On the Inhibition by Artificial Section of the Normal Fission Plane in Stenostoma. Proc. California Acad. Sci. (Third Series). Zool. **2**: 365–376, pl. xvii, 1900.

The question as to the effect of an artificial section of an animal just about to divide by fission was suggested to the senior author of this paper, in the course of his work on monogenesis in ascidians. A partial answer is gained from this study of the common rhabdocoele turbellarian *Stenostoma leucops* O. Schm. The

method taken was to cut across with a small scalpel an individual in which the normal fission plane had become well formed, at some other point of the body than that at which the fission plane was appearing. It was found that when the cut was anterior to the normal fission plane, the formation of this was inhibited and the ganglionic masses which mark its position moved forward till they came to the cut anterior end, where a head was formed. In other words, the tissue which was to form a head migrated as a result of the operation to a position where head tissue would normally never occur. When the cut was posterior to the normal fission plane the latter was not inhibited, but the operation had a distinct retarding influence on its formation. The rule in this case appears to be that the normal fission plane is not completely formed until the posterior piece which has been cut away is wholly regenerated.

In the theoretical discussion a comparison is made between the regulation shown in this case and that of the blastomeres of the segmenting egg. It is thought that the fundamental cause of the migration of the ganglionic cell mass is to be found in the "*specific form of the animal*," or, to quote the exact words of the authors: "We may conceive all the tissues of the individual animal to be in a state, not of *equi*-librium, but of *Stenostoma*-librium; and that when this is disturbed in any way the whole system *together* tends to re-establish it; and this may be done *through* physico-chemical means."

The paper is one of great interest and suggests many possibilities. R. P.

Gaule, J. Ueber den Einfluss der Jahreszeit auf das Gewicht der Muskeln bei Fröschen. Arch. f. d. ges. Physiol. Bd. 83, p. 81, 82. Taf. V, 1900.

Ueber die geschlechtliche Differenz der Muskeln bei Fröschen. Ibid. p. 83–88. Taf. V, 1900.

In these papers are given the results of a series of weighings of certain muscles of frogs of both sexes, at different seasons of the year. It is found that during the summer while the frogs are feeding the muscles take on weight, while in the winter months, when there is no feeding and the sexual products are being formed, the muscles lose weight. The muscle weight of the males is at all times greater, per unit of body weight, than that of the females. Physiological measurements were also made of the relative amounts of work done by the isolated gastrocnemius muscles from the two sexes, when they were put under the same experimental conditions and stimulated in the same way. The results here show that the muscle of the male shortens more in contracting than that of the female, but, on the other hand, the muscle from the female raises a slightly greater weight than that of the male. The product gained by multiplying the height through which the weight is raised by the amount of the weight, gives a measure of the work done, and from determinations made in this way it appears that the muscle of the male frog is capable of doing more work than that of the female. The author believes that the material for the formation of the sexual products is taken directly from the muscles where it has been stored during the summer feeding season. These differences in the condition of the muscles between the females and the males are thus thought to be due to the greater amount of energy required in the forming of the sexual products in one case, over that required in the other. R. P.

CURRENT BACTERIOLOGICAL LITERATURE.

H. W. CONN.

Separates of papers and books on bacteriology should be sent for review to H. W. Conn, Wesleyan University, Middletown, Conn.

1. **Moore, V. A.** Directions for Beginners in Bacteriology. Ginn & Co., Boston, Mass.
2. **Frost, W. D.** A Laboratory Guide in Elementary Bacteriology. Madison, Wis.
3. **Curtis, H. J.** Essentials of Practical Bacteriology. Longmans, Green & Co., New York.

The very rapid development of courses in bacteriology has led to the appearance of quite a number of outlines for practical bacteriological courses. The three books here referred to are all designed as laboratory guides. The first, by Dr. Moore, gives a series of sixty-four lessons in bacteriological technique, covering the general topics which students study in practical bacteriology. The Laboratory Guide, by Frost, is more specially designed as a laboratory note-book in the study of bacteriology. About half of it is taken up with blanks to be used by students in describing species of bacteria, while the other half is devoted to various exercises in general bacteriology. The Practical Bacteriology, by Curtis, is a somewhat more extended work, and contains a great deal more information than the other two books. It is full of illustrations of apparatus and laboratory devices, as well as of the chief species of bacteria. In addition to laboratory technique it gives a large amount of information in regard to various bacteria, and their relations to disease. This work is especially useful as giving the student not only a knowledge of laboratory technique, but also a great amount of information in regard to the significance of the organisms which he is studying. The work is especially full in its descriptions of some of the more unusual forms of bacteria. Ringworms and cancer are considered in very considerable detail, with the purpose of indicating lines of research for advanced students. A more detailed study of the Actinomyces and its allies is given than can be found in most works of bacteriology. For these reasons the student will obtain from the work much more than would be indicated by a common course in laboratory bacteriology. H. W. C.

Dinwiddie. The Relative Susceptibility of Domestic Animals to the Contagion of Human and Bovine Tuberculosis. Bul. No. 63 Ark. Agri. Exp. Sta.

The author has conducted some very suggestive experiments to test the conclusion as to whether the bovine and human tubercle bacillus are, as has been claimed by Smith, different in their pathological properties. For this purpose he experiments not only with cattle, but with other animals. The result of the experiment is not only to verify Smith's conclusions, but to extend them. He finds that the bovine bacillus is always more virulent than the human bacillus, and that this is true whether the tests are made on cattle, sheep or pigs. So far as his experiments go, they appear to indicate that the bovine bacillus is more virulent for all susceptible animals. It certainly appeared to be for all animals experimented with, and the author infers that it is also more virulent for men. This inference, which is of extreme importance, the author recognizes, however, as not yet proved. H. W. C.

Obermuller. Ueber neuere Untersuchung des Vorkommen echter Tuberkuloseereger in der Milch und den Molkereiprodukten betreffend. Hyg. Rund., **10**: 845, 1900.

Having been for many years engaged in the study of tubercle bacilli in dairy products, the author in this article summarizes his general conclusions in regard to the proper relation which should be taken towards this highly important problem. These conclusions are hardly capable of brief summary. The most important are as follows: Milch cows should be subjected to obligatory inoculation by tuberculin under state law. Bovine tuberculosis can be reduced and, perhaps, largely gotten rid of by the gradual destruction of tuberculous animals which show signs of the disease, especially those with udder tuberculosis. For infants and invalids especial care should be taken to use milk from sound cows only. Cream freed from tubercle bacilli should alone be used for butter making. General mixed milk from the market is a source of danger, unless such milk is pasteurized. The author advocates the establishment of governmental bacteriological stations, whose duty it shall be to test market milk for the tubercle bacillus and other pathological bacteria.

H. W. C.

Tobler, Maria. Beitrag zur Frage des Vorkommens von Tuberkel bacillen und anderen Saurefesten Bacillen in der Marktbutter. Zeit. f. Hyg. u. Infec., **36**: 120, 1901.

The author takes up the investigation of the tubercle bacillus and its allies in the market butter of Zurich. The conclusions reached are, in general, in accordance with those obtained by others, inasmuch as true tubercle bacilli are found in a certain number of the samples of market butter. The special point of interest in the investigation is the discovery of five new species of bacilli in the butter, which microscopically resemble the tubercle bacillus and have the same power of holding stains against the action of acids. These five "sauerfest" bacteria are pathogenic for various animals, but they are wholly different from the tubercle bacillus and different, also, from the similar organisms described by Rabinowitsch and others.

H. W. C.

Rabinowitsch, Lydia. Ueber die Gefahr der Uebertragung der Tuberkulose durch Milch und Milchprodukte. Cent. f. Bak. u. Par. 1, 29, p. 309, 1901.

Befund von Sauerfest tuberkelbacillenännlichen Bakierium bei Lungen gangran. Deutsch Med. Woch, 1900.

The author has continued the investigations upon tubercle bacilli in dairy products, in which she has for some years been engaged. Her general conclusions are expressed as follows: Three dairy supply companies which regularly test their cows with tuberculin, and whose milk she has carefully studied, furnish a product entirely free from tubercle bacilli. Other dairies, that depend entirely upon clinical examinations by veterinarians, furnish milk which frequently contains living, virulent bacilli. The conclusion is, of course, that a clinical examination of cows is insufficient to guarantee the freedom of the milk from tubercle bacilli. The author recommends the sale of milk from herds tested with tuberculin at a price higher than that of ordinary milk.

In the second article the author discovers in the sputum of persons suffering from gangrene of the lungs, a bacillus which is microscopically identical with the tubercle bacillus. The organism in question, upon careful study, proves not to be the tubercle bacillus, but one of the "sauerfest" bacilli which are coming now to be recognized as so abundant in dairy products.

The author makes no attempt to draw any casual connections between the disease and the bacillus.

H. W. C.

NOTES ON RECENT MINERALOGICAL LITERATURE.

ALFRED J. MOSES AND LEA MCI. LUQUER.

Books and reprints for review should be sent to Alfred J. Moses, Columbia University, New York, N. Y.

Clarke, F. W. The Constitution of Tourmaline. Am. Jour. Sci. iv, 8: 111, 1899.

Recent investigations of Penfield and Foote have led the author to modify in some particulars his formulæ proposed in 1895.

Clarke regards all tourmalines as derived from the alumino-boro-silicate acid $H_{14}Al_5B_3Si_6O_3$, with all the H atoms replaceable by bases. Using the formula:

$$Al_5(SiO_4)_6\ (BO_2)_2 \cdot BO_3H_2 \cdot H_{12},$$

which is applicable to the discussion of the analyses, the author shows that the results of analyses can be expressed by the combination of different molecules, which are all derived from the general formula by the substitution of different bases for H. For example, the composition of the brown Gouverneur, N. Y. tourmaline corresponds to the following molecular mixture:

5. $Al_2\ (SiO_4)_6\ (BO_2)_2 \cdot BO_3Ca \cdot Mg_4H_4$,
3. $Al_2(SiO_4)_6(BO_2)_2 \cdot BO_3Mg \cdot Mg_4H_4$,
2. $Al_2(SiO_4)_6(BO_2)_2 \cdot BO_3NaH \cdot Al_2Na_2H_4$.

An elaborate chemical discussion is given and many examples cited.

Future investigations may prove tourmaline to be derived from a complex boro-silicic acid; hence the constitution must still be regarded as unsettled.

L. McI. L.

Foote, W. M. Note on a New Meteoric Iron, found near the Tombigbee River, in Choctow and Sumter Counties, Alabama. Am. Jour. Sci. iv, 8: 153, 1899.

The occurrences are of the usual type, the disintegration of the iron being rather marked. Schreibersite was found to be present. The plessite in one specimen exhibited, under etching test, a beautiful phenomenon suggestive of a metallic sun-stone.

The course of the meteorite must have been from N to S; as after breaking up the fragments were found in this direction, the smaller having fallen first.

L. McI. L.

Foote, W. M. Note on a New Meteoric Iron found near Iredell, Bosque Co., Texas. Am. Jour. iv, 8: 415, 1899.

Resembles most siderites, but Widmannstätten figures did not appear on etching, hence probably a distinct fall from the other meteorites of that region.

L. McI. L.

Termier, P. Sur la composition chimique et les propriétiés optique de la leverriérite. Bull. Soc. Min. 22, 27, 1899.

The general description is given in a previous article.

Analysis gives:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	loss by calcination (nearly all H_2O)
49.90	37.02	3.65	0.30	tr.	1.13	8.65 = 100.65,

yielding formula $(H_2, K_2)O \cdot Al_2O_3 \cdot 2SiO_2$, somewhat similar to that of Muscovite. G. = 2.6. Axial angle varies from 0°–50°, but is generally small.

Optical character negative. γ (pract. equal β) = 1.582, α = 1.554, $\gamma - \alpha$ = 0.28 (by Wallerant on Quarter-Gaillard material. Author finds double refraction variable from 0.02 to .0.03.

The mineral occurs in an argillaceous band in a bed of coal at the Fontannes pits. L. McI. L.

Farrington, O. C. Publications Field Columbian Museum. Geol. Series, **1**: 221–241, Feb. 1900.

Inesite. Crystals of the rare mineral, inesite, from San Cayetano mine near Villa Corona, Durango, Mexico, exhibit the following forms (100), (010), (001), (201), $(0\bar{1}\bar{1})$, (11.0.12), and (946), of which the two latter are new. An analysis recalculated to 100 per cent. gave the following:

	Analysis Calc. to 100.	Theory.
SiO_2	44.76	42.91
MnO	38.86	40.51
CaO	8.21	8.00
H_2O	8.17	8.58
	100.	100.

from which the formula $H_2(Mn \cdot Ca)_6Si_6O_{19} + 3H_2O$ is deduced.

Caledonite. Crystallographic examination of the rare mineral, caledonite, from the Stevenson-Bennett mine, Organ Mts., near Las Cruces, New Mexico. Eight forms were identified and from measurements in the zone of the basal and macropinacoids, the author concludes that the crystals are orthorhombic.

Gay-lussite. Examination of microscopic crystals of gay-lussite from Sweetwater Valley near Independence Rock, Wyoming.

Epsomite. Crystals of epsomite from Wilcox Station, Wyoming, described.

Golden Calcite. Calcite crystals from concretions of the Fort Pierre shale of the Bad Lands, South Dakota, described. Distorted crystals with the rhombohedron, –2 as the dominant form.

Dolomite used as Indian Money. Perforated cylinders of dolomite from near Lakeport, Lake county, California. A partial analysis gave CaO 28.27; MgO 22.46, Fe 1.18, which percentages are near those of normal dolomite.

Crystal Forms of Calcite, from Joplin, Mo. A crystallographic study of the calcites of this interesting mineral locality. The author distinguishes five types of crystals with the following forms. R, 4, $-\frac{1}{2}$, $-\frac{4}{5}$, $-\frac{7}{5}$, –2, –4, –11, –20, $1\frac{5}{8}$, 1^3, $\frac{2}{5}{}^2$, $\frac{1}{4}{}^3$ of which Ω, –20, is new for calcite. Twin crystals are described with O, and $-\frac{1}{2}$ as twinning planes, those with the latter twinning planes resembling some from Guanajuato, Mexico, described by Pirrson. A. F. R.

Palache, Charles. The Crystallization of Calcite, from the Copper Mines of Lake Superior. Geol. Surv. Mich. **6**: 161-184, 1900.

An exhaustive study of the calcite crystals of Lake Superior, which perhaps in symmetry and beauty rival those of any other locality. Eighty-seven forms with eight doubtful ones are described in detail. Of these thirty-two are described as new, but $\psi \{ 11.1.\bar{1}0.0 \}$ was previously given by Schnorr. (Abstr. Zeit. f. Kryst. 30.660) and $\mathfrak{C} \{ 4.20.\bar{2}\bar{4}.17 \}$ minus $\frac{16}{17}$ to $\frac{3}{2}$ power by Sansoni (Giorn. Min. 1.136).

Crystals twinned according to the two laws O, and $-\frac{1}{2}$ are described.

A gnomonic projection of all the forms adds to the value of the paper. Details of the measurements, which were for the most part made on the two-circle goniometer, are to be given in a forthcoming number of the Zeitschrift für Krystallographie. A. F. R.

MEDICAL NOTES.

EHRLICH'S TRIACID MIXTURE FOR STAINING BLOOD.

Orange G, sat. aq. sol.,	30.
Säurefuchsin, " "	20.
Methyl Green, " "	33.
Alcohol, absolute,	25.
Glycerin,	50.
Water, dist.,	75.

Unless the solutions are absolutely saturated before mixing, results will be unsatisfactory. In making up the mixture, the orange G and acid fuchsin are first thoroughly mixed; then, drop by drop, the methyl green is added, the solution being well shaken after each addition. The other three elements are then added, and the whole shaken thoroughly.

When the stock solution is once prepared it should never be shaken, but the desired amount drawn from the top by means of a pipette. The specimen to be stained is prepared in the usual manner by heat, and over the cover-glass spread is placed a drop of the stain, which is allowed to remain for two or three minutes or longer, if desired, after which the specimen is washed in water. Care must be taken in the application of heat during the staining process, for if too much heat is applied the specimen becomes pale yellow and is indistinct under the microscope; while if not enough heat is applied the specimen is too dark.

After being thoroughly washed in water, the specimens are dried with filter paper and mounted in Canada balsam. If the mixture is properly made it will keep for years. C. W. J.

METHOD FOR CULTIVATING AND STAINING THE DIPHTHERIA BACILLUS (*Weiner Medical Wochenschrift*, No. 10, 1900).—Twist a small piece of absorbent cotton, impregnated with glucose glycerinated agar-agar, around the end of a sterilized glass rod. A supply of these rods thus prepared may be kept on hand, each in a sterilized test tube. To make a culture the cotton is swabbed over the affected material, and the rod returned immediately to the test tube. After being kept in the incubator at a temperature of 36° to 37° for four or five hours, enough baccilli will have developed to make a smear. This is stained with the following methylen blue solution:

Methylen blue,	1 gm.
Alcohol,	20 c.c.
Water, dist.,	420 gms.
Acetic acid,	50 gms.

This solution must not remain on the specimen more than two or three seconds, after which time the slide should be thoroughly washed with water. For a counterstain the following is used:

Vesuvin,	2 gms.
Water,	1000 gms.

which is heated, and filtered while still warm.

The vesuvin should act on the specimen for fifteen to twenty seconds, being then washed off with water.

In absence of true bacilli, the smear appears brown. If both true and pseudo bacilli are present, a blue and brown color is visible. The true bacilli stain brown with their polar ends blue, while the pseudo bacilli stain wholly brown.

C. W. J.

NEWS AND NOTES.

THE ACADEMY OF SCIENCE OF ST. LOUIS.—At the meeting of the Academy of Science of St. Louis, on April 1, 1901, thirty-three persons present, a memorial notice of the late Judge Nathaniel Holmes, a charter member of the Academy, was presented by a committee composed of Professor Nipher, Dr. Sander and Dr. Baumgarten.

Dr. John S. Thurman delivered an address on the many industrial uses now made of compressed air, illustrating his remarks by apparatus in operation, including electric motor air compressor, compressed air auger, drill, disinfecting atomizer, sculptors' and stone-cutters' tools, carpet renovators, etc., and a set of lantern slides showing the practical uses made of these and other implements and machines operated by means of compressed air.

Dr. Theodore Kodis exhibited, under the microscope, slides illustrating a new method of staining brain tissue, whereby, in four or five days, it has proved possible to prepare single or double stained preparations containing nerve cells with the dendrites of the latter brought out by a direct stain, instead of being differentiated merely as amorphous silhouettes, as is the case with the much slower Golgi process commonly employed. It was stated that the material is treated before sectioning, for about twenty-four hours, with cyanide of mercury, followed for approximately the same length of time by a formaldehyde solution, after which sections are cut, stained with phosphomolybdate hæmatoxylin and, if desired, a contrasting stain, such as one of the anilin greens, and mounted in the usual way.

WILLIAM TRELEASE,
Recording Secretary.

We have received an announcement of the Summer School for Apprentices and Artisans, which will be held at the University of Wisconsin, from July 1st to August 9th of this year. The school has been established for the benefit of machinists, carpenters, or sheet metal workers; stationary, marine, or locomotive engineers; shop foremen and superintendents; superintendents of waterworks, electric light plants, power stations, factories, large offices and store buildings in cities; and for young men who wish to qualify themselves for such positions. The purpose is to give to apprentices a certain amount of theoretical and practical instruction in the line of their trade, which they would not get in the shops.

No detailed educational requirements are specified for entrance, the fitness of the applicant being determined by a series of questions to ascertain whether or not he seems likely to be benefited by the work, and not be a hindrance to others.

It is believed that employers can well afford to give intelligent, ambitious young men leave of absence from actual employment in order that they may increase their efficiency by availing themselves of the advantages offered in such sessions as the one outlined for this summer at the University of Wisconsin. Persons desiring to attend this school during the coming summer are asked to make application on or before June 1, 1901, to J. B. Johnson, Dean College of Engineering, University of Wisconsin.

THE COLD SPRING HARBOR BIOLOGICAL LABORATORY.—The twelfth session of the biological laboratory of the Brooklyn Institute of Arts and Sciences will be held at Cold Spring Harbor, L. I., from Wednesday, July 3d, until August 13th. The following courses are offered: Professor C. B. Davenport, University of Chicago, high school zoölogy; variation and inheritance. Professor H. S. Pratt, Haverford College, comparative anatomy. Dr. L. E. Griffin, Western Reserve University, invertebrate embryology. Dr. A. G. Mayer, Brooklyn Institute Museum, entomology. Professor E. B. Copeland, West Virginia University, cryptogamic and physiologic botany. Mr. H. H. Whitford, University of Chicago, plant ecology. Professor N. F. Davis, Bucknell University, bacteriology. Mrs. C. B. Davenport, microscopic methods. Dr. H. A. Kelly, Ethical Culture Schools, nature study. Professor S. R. Williams, Miami University, will give instructions in animal bionomics; Professor W. L. Tower, Antioch College, assists in entomology, and Mr. A. F. Blakeslee, Harvard University, in botany. Louise B. Dunn, Barnard College, assists in ecology. A new laboratory, exclusively for investigators, is announced. The dining and rooming accommodations are under the immediate control of the laboratory. There is a uniform fee of twenty-five dollars for study at the laboratory; private rooms are fifty dollars for the entire season. Board and room costs six dollars per week. Correspondence should be addressed to the director, Professor C. B. Davenport, University of Chicago, Chicago, Ill.

QUESTION BOX.

Inquiries will be printed in this department from any inquirer.
The replies will appear as received.

What is meant by the "*growing* tip" in Allium—when used for mitosis as figured in Wilson's book on the Cell?—V. A. L.

Can synthol be used in place of carbolic acid?—V. A. L.

What are the three formulæ of Kaiserling's solution, so often quoted?—V. A. L.

Can a Welsbach light be used in photo-micrography with $\frac{1}{12}$ H. I. objective and an achromatic ocular, and give light enough to focus on ground glass screen? —V. A. L.

Can H. I. lenses $\frac{1}{18}$, $\frac{1}{12}$, $\frac{1}{10}$, etc., be used in photo-micrography with a Welsbach gas light only, using Abbe condenser and bulls-eye with an *ocular in place?* The light on the focusing screen is so dim as to render the object indiscernible. Is an aplanatic ocular prone to give more light for this purpose?—C. L. P.



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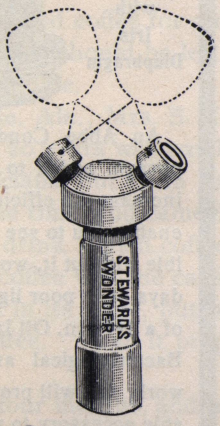
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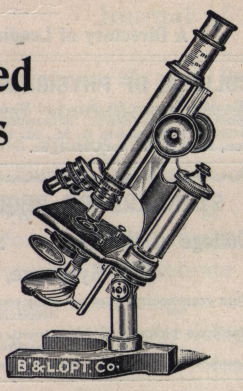
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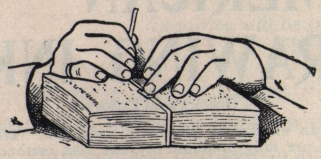
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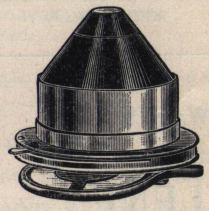
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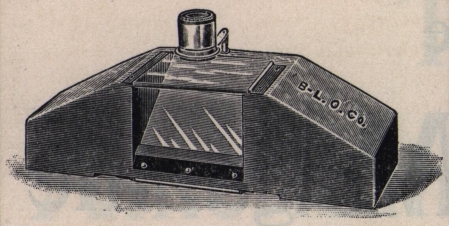
Original Articles in the December Number, 1900.

ITO, T.—Plantæ Sinenses Yoshianæ, X.
ASO, K.—A Physiological Function of Oxydase in Kaki-Fruit.
ICHIMURA, T.—Pflanzenverbreitung auf dem Tateyama in der prouing Etchu.
MAKINO, T.—Pflantæ Japonenses Novæ vel minus Cognitæ.

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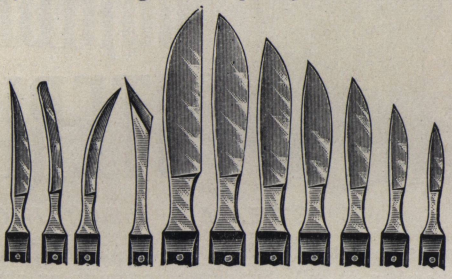
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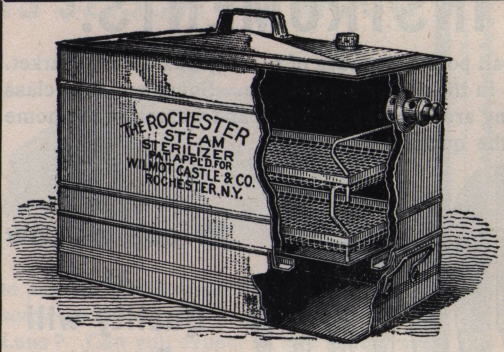
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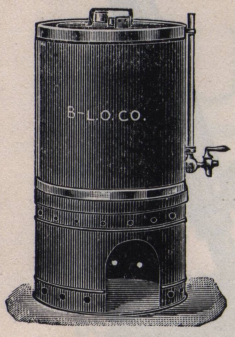
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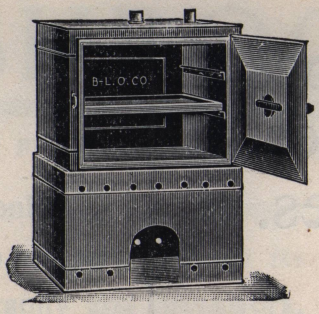
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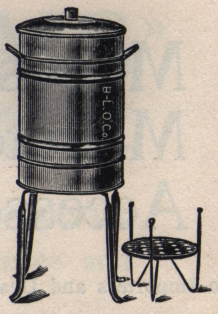
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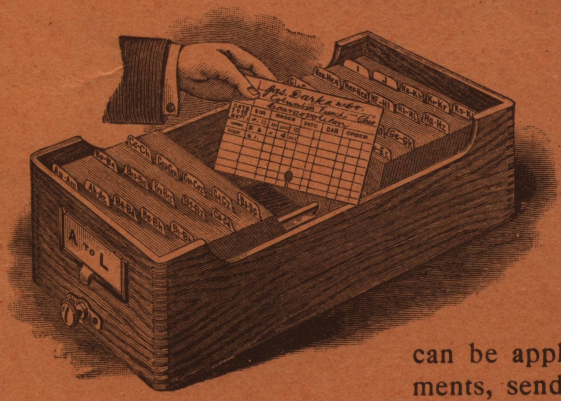
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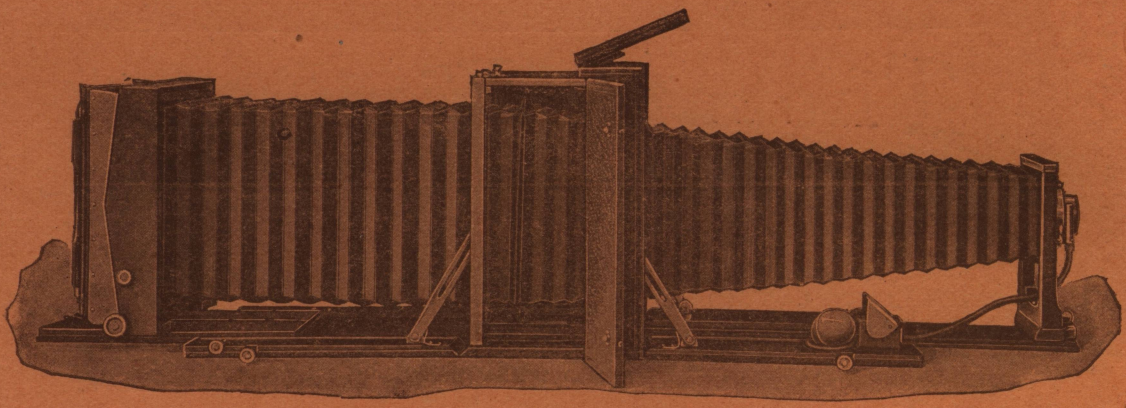


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